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# REPORT

OF THE

# DIRECTOR OF THE MINT

UPON THE

# PRODUCTION

OF THE

# PRECIOUS METALS IN THE UNITED STATES

DURING THE

CALENDAR YEAR 1883.

WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1884.

TREASURY DEPARTMENT,
Document No. 604.
*Secretary—S., P. & B.*

TREASURY DEPARTMENT, *June* 2, 1884.

SIR: I have the honor to transmit herewith the report of the Director of the Mint upon the statistics of the production of the precious metals in the United States for the calendar year 1883.

Very respectfully,

CHAS. J. FOLGER,
*Secretary.*

HON. J. G. CARLISLE,
*Speaker of the House of Representatives.*

# LETTER OF TRANSMITTAL.

TREASURY DEPARTMENT,
BUREAU OF THE MINT,
*Washington, D. C., June* 2, 1884.

SIR: I have the honor to submit herewith my report upon the production of gold and silver in the United States during the calendar year 1883. The information obtained from the officers and records of the mints and assay offices, and by inquiries and investigations emanating from those institutions, as well as this office, to ascertain the amount and character of the bullion produced in the various mining districts of the United States, has been supplemented by special returns direct to this Bureau from express and railroad companies, from the owners, managers, or superintendents of mines, mills, and smelting and refining works, and bankers, dealers, and exporters of bullion, and their several statements have been carefully compared and tested, and the general conclusions derived as to the amount of gold and silver obtained from the mines in each State and Territory, and the several counties and districts, are embodied in this report.

The completion of the work has been somewhat delayed by the sudden death of Dr. Frederick Eckfeldt, who had been assigned to the special charge of the collection and compiling of statistics relating to production, and for the last three years had ably assisted in this branch of office labor, and whose ability, accuracy, and discriminating judgment are evidenced in many valuable tables prepared by him for the preceding volumes and interesting reviews of mining regions which he had visited, and with which he was familiar.

For assistance and information received through the officers of the mints and assay offices in regard to the mines in their respective localities, I have given credit in the chapters relating to the respective States and Territories; and I have also endeavored to acknowledge the detailed descriptions and statistics of production furnished by the hundreds of correspondents who have given this work their hearty co-operation. Full returns have been obtained from many of the express, and all of principal railroad, companies whose lines are operated in the mining regions, and are employed in the transportation of ore and bullion. The facts and statistics they have furnished have been found invaluable in endeavoring to ascertain the actual yield of mines and the total production of localities. Where published statements apparently accurate and reliable have stated the yield and condition of mines, the character and value of their ores, I have considered the data thus given of sufficient importance to be reproduced or succinctly stated in reviewing the locality, and to be carefully weighed, in connection with other information, in estimating the probable production.

I have found Mr. Valentine's annual estimate and the detailed information furnished by him and other officers of express companies of great value in enabling me to verify the statements and data obtained from other sources.

Mr. Edward O. Leech having been promoted to the position of computer of bullion, made vacant by Dr. Eckfeldt's death, was placed in charge of the statistical division, and I desire in conclusion to acknowledge my indebtedness to him and the other clerks in my office, whose names I have specially mentioned in the appropriate place, for their efficient aid in this review of mining industry.

Very respectfully,

HORATIO C. BURCHARD,
*Director.*

Hon. CHARLES J. FOLGER,
*Secretary of the Treasury.*

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# PART I.

## PRODUCTION OF STATES AND TERRITORIES.

# PRODUCTION OF STATES AND TERRITORIES.

During the year 1883 the mints and assay offices of the United States received deposits and purchases reported to be domestic bullion containing, gold, $30,013,366.20; and silver, $32,444,184.67. The customs returns make the exports of domestic bullion at the port of New York, gold, $23,789; silver, $8,385,740; and at San Francisco, gold, $28,465; silver, $5,676,575; a total of $52,254 gold and $14,062,315 silver, the latter reckoned at its commercial value, according to the statements of the revenue officers at those ports, respectively.

The tables accompanying this report show that no gold bars were manufactured at the mints and New York assay office for exporters, and that silver bars not redeposited, and Hawaiian coins to the value of only $1,909,640, were made for depositors at the San Francisco mint. From the sum of the deposits and exports of domestic bullion no deduction need therefore be made on account of domestic gold deposited at the mints and assay offices having been exported, and only the value of the fine bars and Hawaiian coin, $1,909,640, need be deducted from the domestic silver exports and deposits on account of deposited domestic silver included in the silver exports.

The total value of the domestic gold exports and deposits was $30,065,620; but this does not represent the total gold production of the United States during the year, and must be increased, not only by the amount of gold contained in ores and silver bullion sent to foreign countries for treatment, but by the value of the gold of domestic production used by manufacturers not deposited at the mints and assay offices. As to the former, one of the largest exporters of silver bullion states that the doré bars shipped by him during the year contained in $4,000,000 worth of silver bullion $282,000 worth of gold. A much larger amount of domestic gold was furnished to manufacturers in the form of bars from private refineries and in native grains, nuggets, &c., for the responses to inquiries made at the close of the year to ascertain the amount of the precious metals used in the arts and ornamentation show that besides $7,135,218 of stamped United States and refinery gold bars they used $785,747 of gold in the form of native grains, nuggets, &c. These figures alone add $1,067,747 and would swell the domestic gold product of the year to $31,133,367.

But a portion of the refined gold bullion entered at the San Francisco mint as of domestic production probably included foreign bullion received and refined in that city at private refineries and subsequently deposited in the mint as refined domestic bullion. That the latter did include nearly one million of foreign gold bullion is evident, because while the imports of foreign gold bullion at San Francisco mint amounted to $1,970,276, and no foreign and only $28,385 of domestic gold bullion was exported, the deposits at the San Francisco mint of foreign bullion were reported from that mint at only $1,772,130, leaving two hundred thousand of foreign gold bullion, the disposition of which can be reasonably accounted for only upon the hypothesis that it was deposited at the mint in that city and entered as domestic bullion.

Besides this $1,970,276 gold bullion imported through the custom-house and entered as domestic bullion, more than three-fourths of a million of dollars worth of gold was brought into the country from the west coast of Mexico, according to Mr. Valentine's statement, and was not entered in the custom-house returns, for he reports $767,836 of gold dust and gold bullion brought by express from that region, while only $15,153 of gold bullion was entered at the custom-house as received from Mexico. All of this foreign gold bullion, except such small portion as may have been used in manufactures, both that imported through the custom-house and brought by express, the total exceeding the reported deposits of gold bullion by $965,982, doubtless went to the mint and was entered as domestic bullion.

It seems proper, therefore, that the amount of undeposited domestic gold bullion exported and used in the arts should be offset by the foreign gold bullion, almost an equal amount, received at the San Francisco mint and credited as of domestic production.

For these reasons I consider the $30,013,366 deposited and entered as domestic gold at the mints and assay offices during 1883 as a near approximation to the yield of gold from the mines of the United States during that period, being in round numbers $30,000,000.

As to silver, the declared value of the silver bullion exported at New York, $8,385,740, was estimated at its commercial value, say, $1.10 an ounce, which, carried to its coining value in standard dollars, equals $9,811,917.

Of the $5,676,575 silver bullion exported from San Francisco, worth at its coining rate $6,641,200, nearly one-third consisted of fine silver bars and Hawaiian coin manufactured at the San Francisco mint, for its records show that such bars were issued and not redeposited, amounting to $1,512,150, and that $397,490 worth of bullion was converted into Hawaiian coins, both of which, amounting to $1,909,640, were probably exported. This would reduce the export of silver bullion that had not been deposited at the San Francisco mint to $4,731,560.

This, however, must include some foreign silver bullion, for Mr. Valentine reports the receipt by express from the west coast of Mexico of silver bullion valued at $3,870,548, which doubtless consisted in part of Mexican silver dollars sent by express to San Francisco for export, as the exports of foreign silver coin from San Francisco to China, Hong-Kong, and Japan, evidently Mexican dollars, were $4,147,681, while the imports of silver coin from Mexico, as entered through the custom-house, were $2,193,499, showing an export over import of $1,954,182 of Mexican dollars, which probably were brought by express. Deducting this amount as coins from the silver brought by Wells Fargo, leaves $1,916,366 of foreign bullion to be accounted for. Besides this, there was brought from Mexico, through the custom-house, silver bullion of the value of $1,943,362. This, added to that brought by express, $1,916,366, makes $3,859,728 in silver bullion to be accounted for.

Of this, $1,902,759 was deposited at the mint as foreign bullion, and the remainder, $1,956,969, must have either gone to private refineries and afterwards exported, or deposited at the mint as domestic. In either case it should be deducted from the exports of domestic silver not deposited at the mint, $4,731,560, leaving as the amount of domestic silver exported at San Francisco $2,774,591.

To the domestic silver bullion deposited at the mints and assay offices, $32,444,185, should therefore be added $2,774,591 undeposited domestic silver bullion exported from San Francisco, together with $9,811,917 exported from New York, a total of $12,586,508; no silver bullion having been exported from other ports.

Silver bars prepared from domestic bullion that had not been deposited at the Government institutions were doubtless furnished to manufacturers by private refineries, for only $13,080,190 silver bullion, less than one-third of the total domestic product of the United States, was refined at the mints and New York assay office, and a large portion of the remainder was refined at private establishments, as the New York assay office alone supplied silver bars for manufacturing purposes to the value of $5,166,229, of which $4,575,769 is reported to have been domestic bullion. To add $600,000 for undeposited domestic silver bullion obtained from private refineries for this purpose is probably below the amount actually furnished. Allowance must also be made for the value of silver contained in ores and copper matte shipped abroad for reduction. The shipment statements of the Union Pacific Railroad show that in 1883 the Anaconda mine in Montana exported to Liverpool 11,602 tons of ore for treatment, it is said, at Swansea, Wales. The ores of this mine are stated in my report for 1882 to assay 35 ounces in silver, and Mr. Harrison reports its silver production at $600,000. It is a moderate estimate to compute the total value of the domestic silver shipped abroad in this form at $600,000.

The value of the silver produced by the mines of the United States in 1883, as ascertained by these data, was about $46,200,000.

*Domestic silver bullion produced in* 1883.

| | |
|---|---|
| Deposited at mints and assay offices | $32, 444, 185 |
| Other domestic exported in bullion | 12, 586, 508 |
| Other domestic exported in ores | 600, 000 |
| Other domestic used in manufactures | 600, 000 |
| Total | 46, 230, 693 |

The above-estimated total production of Gold, $30,000,000, Silver $46,200,000, was obtained from the several States and Territories as follows:

| State or Territory, | Gold. | Silver. | Total. |
|---|---|---|---|
| Alaska | $300, 000 | | $300, 000 |
| Arizona | 950, 000 | $5, 200, 000 | 6, 150, 000 |
| California | 14, 120, 000 | 1, 460, 000 | 15, 580, 000 |
| Colorado | 4, 100, 000 | 17, 370, 000 | 21, 470, 000 |
| Dakota | 3, 200, 000 | 150, 000 | 3, 350, 000 |
| Georgia | 199, 000 | 1, 000 | 200, 000 |
| Idaho | 1, 400, 000 | 2, 100, 000 | 3, 500, 000 |
| Montana | 1, 800, 000 | 6, 000, 000 | 7, 800, 000 |
| Nevada | 2, 520, 000 | 5, 430, 000 | 7, 950, 000 |
| New Mexico | 280, 000 | 2, 845, 000 | 3, 125, 000 |
| North Carolina | 167, 000 | 3, 000 | 170, 000 |
| Oregon | 660, 000 | 20, 000 | 680, 000 |
| South Carolina | 56, 500 | 500 | 57, 000 |
| Utah | 140, 000 | 5, 620, 000 | 5, 760, 000 |
| Virginia | 6, 000 | | 6, 000 |
| Washington | 80, 000 | 500 | 80, 500 |
| Wyoming | 4, 000 | | 4, 000 |
| Other (Alabama, Tennessee, &c.) | 17, 500 | | 17, 500 |
| Total | 30, 000, 000 | 46, 200, 000 | 76, 200, 000 |

This is a decline from my estimate of the production for 1882 in gold of $2,500,000, and in silver of $600,000. The falling off in gold has been most marked in California. Colorado has made a creditable advance in both gold and silver. Nevada reversed its downward movement from its former place at the head of the column of gold producers, changing places with Montana. The latter and New Mexico largely increased the output of their silver mines, which they promise to augment in the coming year.

The discovery during the latter part of the season of a new god fieldl in the mountains of Northeastern Idaho excited considerable interest and attracted a large immigration of prospectors and miners. The extent and value of this addition to the gold supply have not as yet been definitely ascertained, and are probably overestimated.

The deposits of domestic bullion at the mints in 1883 were $1,364,883 less in gold, and $1,043,392 greater in silver, than in the previous year, but the bullion sent to the refineries contained $3,000,000 more gold and $1,000,000 less silver.

Besides the gain to the gold supply from the mines of the country, the net import above the foreign and domestic export of gold coin and bullion was $16,005,187, making a total gain from the mines and imports of $46,005,187.

## ASSESSMENTS.

The mines have not surrendered their stores without the expenditure of labor and capital almost equal to the value of the product obtained. Besides the capital from time to time invested in the discovery and development of new, or expended in the search for new ore-bodies in old, mines, it has been found necessary, after exhausting the receipts from the sale of the mineral wealth obtained, in many cases to call upon owners to make advances for prosecuting further development or making improvements for mining and treating the ores. How much new capital has been voluntarily advanced for purchasing, opening, or improvement of mines, or has been obtained from assessments upon stockholders during the year, it is impossible to state.

Assessments are reported to have been made in six States and Territories upon the stockholders in one hundred and forty-eight incorporated mines, calling for $5,688,284, as follows:

| | Assessments. |
|---|---|
| Arizona | $165,500 |
| Alaska | 20,250 |
| California | 1,196,044 |
| Dakota | 10,000 |
| Nevada | 4,244,490 |
| Utah | 52,000 |
| Total | 5,688,284 |

Other mines, however, have gratified their owners with substantial evidences of profits. Besides the millions received by the owners of unincorporated mines, the stockholders in 59 mines, in 10 States and Territories, are reported to have received $6,740,050. This amount was distributed in 223 dividends to the States and Territories respectively as follows:

| States and Territories. | Mines. | Dividends. | Amount. |
|---|---|---|---|
| Arizona | 3 | 14 | $600,000 |
| California | 13 | 56 | 1,004,976 |
| Colorado | 17 | 31 | 1,200,750 |
| Dakota | 3 | 18 | 645,500 |
| Georgia | 1 | 6 | 24,000 |
| Idaho | 4 | 16 | 85,000 |
| Montana | 5 | 39 | 513,824 |
| Nevada | 6 | 25 | 584,000 |
| New Mexico | 1 | 5 | 500,000 |
| Utah | 5 | 13 | 1,582,000 |
| Total | 58 | 223 | 6,740,050 |

The detailed review of the operations of the year in the gold and silver mines of the several States and Territories is followed by valuable and recent statistics relating to the movements, treatment, and disposition of the precious metals, and also by articles furnished by able writers and metallurgists upon subjects having an important bearing upon the mining industries of the country. Among the general statistics will be found two tables that may be useful and interesting to monetary statisticians.

## CONSUMPTION OF THE PRECIOUS METALS.

The efforts heretofore made to ascertain the actual consumption of gold and silver in the United States in the arts and manufactures through the medium of circular letters to persons and firms engaged in occupations or business requiring the use of the precious metals, were successfully resumed near the close of the year, with gratifying results. Nearly eight thousand circulars were addressed and forwarded through the mails, and 5,406 responses received, which reported that during the calendar year 1883 2,724 persons or firms had used in repairing or in the manufacture of chemicals, watches, instruments, plate, &c., gold to the value of $14,223,448, silver $5,392,777, a total of $19,616,225. The character of the gold and silver used was as follows:

| Character. | Gold. | Silver. |
|---|---|---|
| United States coins | $4, 653, 487 | $216, 607 |
| Stamped United States or refinery bars | 7, 135, 218 | 4, 392, 772 |
| Old jewelry, plate, and other materials | 868, 119 | 221, 475 |
| Foreign coin | 191, 900 | 154, 273 |
| Native grains, nuggets, &c | 702, 287 | 71, 557 |
| Wire or rolled plate | 672, 437 | 336, 093 |
| Total | 14, 223, 448 | 5, 392, 777 |

These figures indicate a much larger appropriation of the precious metals for purposes of manufacture and ornamentation than any estimate I have previously made, and are especially significant and valuable in ascertaining the metallic circulation, as they show a large and apparently increasing consumption of the gold coins of the country in such industries.

## COURSE OF PRICES.

It is generally conceded that the increase or diminution of the supply of gold and silver in any country has an important influence upon the price of commodities. I therefore present with this report the usual tables showing the average prices during the calendar year in the New York market of the principal domestic commodities and comparing their average prices for the year with those for the year 1882, and for the fifty-six years preceding 1881. The tables indicate, as was to be expected, a considerable reduction in 1883 from the average prices of the same commodities in 1882.

# CHAPTER I.

## ALASKA.

The increasing production of gold from recent discoveries in Southern Alaska has awakened an interest in the geography as well as the geology of that region, of which but little is known. In 1881 deposits of bullion were made at the San Francisco mint of the value of $13,375, said to have been produced in Alaska.

In 1882 the amount increased to $34,011, and in 1883 to $56,072, while Mr. Valentine, who makes no mention of gold carried by express from Alaska in prior years, reports $85,000 to have been carried in 1883.

This continued increase of deposits warrants a proportional increase in the estimated production of Alaska, which was placed in my last report at $150,000 for 1882. I have adopted Mr. Jackson's estimate for 1883—$300,000.

The following review of the mines of Alaska was prepared by E. R. Scidmore, who visited the southern part of Alaska in 1883 and obtained by inquiries and personal observation much valuable information in regard to the location and yield of its gold mines.

I am also under obligations to gentlemen residing or doing business in that region for prompt replies to letters addressed to them at the close of the year, and whose names are specially mentioned in connection with the valuable statements furnished by them in regard to the condition of the mines in their vicinity.

In the reports of preceding years only the briefest mention has been made of the gold fields of Alaska, little being generally known concerning their location and richness, there being great difficulty in obtaining any information. The remoteness of the country and the want of any form of civil government has prevented all but the most daring and hardy adventurers from seeking its gold regions.

For fifteen years the citizens of this neglected region have vainly appealed for the civil protection assured them in our treaty with Russia. The Territory, so called, became the property of the United States by the treaty of March 30, 1867, and was formally transferred at Sitka October 18, 1867, by Capt. Alexis Pestchouroff, of the imperial Russian navy, acting for his Government, to Brig. Gen. Lovell H. Rousseau, commissioner on the part of the United States.

For a few years after the transfer garrisons of United States troops were maintained at the most important points, but they were gradually withdrawn, in the face of violent protests on the part of the residents, who saw themselves left to the mercy of the tribes of hostile Indians inhabiting the archipelago.

In a last desperate moment, when their lives were threatened, the miners and residents at Sitka appealed to a British man-of-war in the harbor of Esquimalt, British Columbia. The British ship remained in the harbor of Sitka for three months until relieved by a United States vessel. Since that time a man-of-war has been detailed for duty in Alaska waters with headquarters at Sitka.

A man-of-war government is becoming less and less fitted to the needs of a country which during the past five years has been developing its resources and sharing in the progress of the nearer Northwest.

The discoveries of rich gold fields in Southeastern Alaska, and the rapid growth of the mining town of Juneau, have increased the necessity for an organized government, for the disputes arising among the miners and with the Indians can only be settled by an appeal to the small man-of-war in the harbor of Sitka, 100 miles distant. Owners of mining property have petitioned for an extension of the land laws of the United States to Alaska, as without surveys or entries for their mineral claims capitalists cannot be induced to venture money in mines or mills that the first organized band of squatters may seize or demolish without fear of punishment. While convinced of the value of the mines, they are not willing to invest until protection to property is assured and some form of government given to this rich but undeveloped country. Isolation from the outside world has greatly retarded its progress as well, but by the completion of the Northern Pacific Railroad, Juneau, the chief mining region of Alaska, can be reached in twelve days from New York.

This region is situated on the mainland and mountainous islands bordering the coast at a point some 200 miles north of the extreme southern boundary of Alaska and about 100 miles northeast from Sitka. Direct communication is maintained by two steamers of the Oregon Railway and Navigation Company making monthly trips from Portland and Puget Sound ports to Sitka and way points.

As in all new countries, the first mines discovered and worked were placers, and they have not yet shown signs of exhaustion. Many quartz lodes have been discovered and a few are being worked, but on the majority only the yearly assessment work is done to insure the owners' claims when a land office is established.

The dense forest growth and the rank vegetation, which botanists assure us is not surpassed in the tropics, make prospecting more difficult and laborious than in any part of the United States.

The moist, even temperature and the long days of the summer force a most luxuriant growth, and fire has never desolated these primeval forests.

The deep sphagnum, or moss, covers the ground so deeply that mineral veins are with great difficulty found or traced. For this reason there has been little prospecting off the water-courses that intersect Southeastern Alaska, as prospecters can seldom make as much as 5 miles in a day through the forests.

There has been great difficulty in reaching anything conclusive concerning the product of the year, as the gold from the few mills in operation is shipped in bullion to Portland and San Francisco, but by far the greatest part of the annual yield is carried on the persons of the miners.

Over forty circulars were sent from this office, addressed to mine owners, superintendents, and business men in Alaska, asking for statistics relative to the gold and silver product for the year. Replies were received from several correspondents, whose statements and information are incorporated in this report.

Alaska having been heretofore dismissed with brief mention, and nothing in connected form having been published concerning the history and development of its mineral resources, it is deemed not amiss to give a brief record from the first discoveries of gold to the present day.

Although scientists had always felt assured that rich bodies of the precious metals must exist in Alaska, the discovery of gold did not occur until after half a century of Russian rule. The colony was leased to the Russian-American Fur Company, the Government only retaining the right of control over lands on which minerals should be found. The governors of the company and their agents were only interested in increasing the fur trade. No attention was paid to the other resources, and every hindrance was opposed to any exploration of the interior.

The Russian-American Company also discouraged mineral prospecting for fear that the development of the mineral resources of the country would injure their interests, draw off their agents, and bring in a horde of adventurers to compete with them in trade.

The governors of the Russian-American Company having absolute power of life and death over the inhabitants, forbade and effectually prevented any one from going into the interior, or making explorations away from the settled posts.

During Baranoff's time it was reported that gold had been found, and one Russian who had been exploring in the mountains, near Sitka, found several rich pieces of quartz, which he took to the governor. Baranoff himself assayed the specimens, but the result was never known, except that the Russian was ordered to cease prospecting or take one hundred lashes.

The Emperor Nicholas, feeling sure that gold must exist in his American possessions, urged that explorations should be made, but even to imperial requests the governor always alleged the hostility of the natives as a reason for not conducting a survey.

The Emperor offered them additional troops, but they evaded it on one plea and another, until he at last sent out from St. Petersburg one Darrehan, a daring officer of engineers, who had volunteered to explore the country and examine into its mineral resources.

Darrehan, crossing Siberia, reached the shores of Russian America in 1855, and with his corps of men spent two years in examining the mountainous shores of the region lying between the Aleutian Islands and Sitka. In many places he found indications of gold, copper, iron, and other metals. After his return to Sitka he made no attempts to explore Baranoff Island, on which the town is situated, and where rich deposits and ledges have since been found. In 1858 he sent his report to the Emperor, condemning the country.

A few years later a Russian engineer, while surveying the shores of Silver Bay, near Sitka, found rich float gold at the mouth of a creek, but no one followed up the discovery or attempted to prospect for the ledge.

When the Russians transferred the Territory to the United States, all the official records, archives, and papers connected in any way with the country were turned over, but the Russians frankly acknowledged that they knew nothing about the mainland or interior, or of any of its resources save the fur trade.

As continued discoveries of gold were made to the northward on the Pacific coast, and the mines of British Columbia were opened, it became evident that the same great mineral belt extending up the coast from Mexico to British Columbia must exist in Alaska, where the three great mountain systems, the Rocky, the Cascade, or Sierra, and the Coast Ranges crossed and converged. It was argued that rich deposits must be found at the crossing of these mountain chains with their rich geological formations, and that explorations would show Alaska to be as rich in minerals as other portions of the Pacific coast, and that the same minerals would be found as in Siberia, and in deposits of equal extent and richness.

No geological survey has ever been made of the country, and the only scientists of note who have examined the geological formations are Prof. William Blake, who visited the Stickeen River in 1862, and Prof. John Muir, State geologist of California, who spent the years 1879 and 1880 in studying the glacial system of Alaska, and following the coast from the southern boundary to the Arctic Ocean.

In his explorations Professor Muir found signs of gold in every stream in the Territory, ground and washed down from the higher ranges by the vast ice sheet which once covered the region, and by the immense glaciers which are still at work at the head of every fiord and river, and in all the deep ravines of the mountains. He considers the mineral veins of Alaska as identical with those of Mexico, New Mexico, Arizona, Utah, Nevada, Idaho, Montana, and British Columbia, and that the mill at the mines on Baranoff Island, near Sitka, stands on the same great lead as those of Nevada.

With the progress of years, all gold discoveries have been to the northward, and the old theory that gold exists only in the tropics is exploded.

With British Columbian mines on one side producing $1,000,000 and $2,000,000 each year, and Siberia on the other yielding its annual $22,000,000, Professor Muir was certain that Alaska would prove to be one of the rich gold fields of North America.

In response to circulars sent from this office in November, asking for information concerning the gold product for 1883, responses were obtained from Joseph Juneau, Richard Harris, J. D. Sage Miller, Capt. James Carroll, F. O. Downing, Karl Kochler, R. D. Willoughby, of Juneau, and Nicholas Haley, of Sitka. The letters of these gentlemen contain much valuable information, as the first three were the earliest prospectors at Juneau, and Mr. Willoughby is one of the oldest pioneers in Alaska.

Capt. James Carroll, master of the mail steamer Idaho, which plies between Portland and the different ports in Southern Alaska, considers that the past season has been the most prosperous one yet known in the growth of this mining region. He estimates the gold product at about $400,000 for the year, and considers that the outlook for the summer of 1884 is most promising. A very large quartz mill is contemplated.

Captain Carroll is part owner in a number of promising mines, on none of which has work been pushed any further than to comply with the requirements of the mining laws.

The establishment of a civil government will transform the mining camps and encourage the investment of capital now awaiting for assurances of the protection of the civil law.

Mr. F. O. Downing, purser of the Idaho and agent for Wells, Fargo & Co., and for the Northern Pacific Express Company, places the gold product of the year 1883 at $400,000, estimating it from the amounts carried down in his safe on the monthly trips of the steamer, and from the amounts known to have been carried on the persons of the miners.

Mr. Downing is part owner of some of the valuable claims on Douglas Island, and in the spring refused an offer of $80,000 for the claim adjoining the Treadwell property, which he owns in partnership with Captain Carroll.

Joseph Juneau, the pioneer prospector, in whose honor the town was named at the miners' meeting in May, 1882, writes that "his quartz mines have so far only been prospected by doing the yearly assessment work, and some $2,000 have been obtained by arrastras." He estimates the product of the placer mines worked upon the surface of quartz locations at $150,000, and is unable to give a complete estimate of the product of the region.

Richard Harris, partner of Joseph Juneau, reports the average of his gravel mining claims at $30 and $20 a day per man, and at times he has taken out as high as $85 per day. He places the whole product of the Silver Bow Basin mines at $450,000 for the three years since their discovery, giving an average of $150,000 for each year.

R. D. Willoughby, who has prospected in all parts of Alaska, is most sanguine as regards its mineral wealth and future development. He estimates the product of 1883 at $450,000, in placer fine gold, and porphyries, and predicts the development of rich gold and silver quartz mines as soon as capitalists are given the protection of a civil government.

J. D. Sagemiller, who has been at Juneau since the discovery of gold, writes a very interesting letter which I deem of sufficient interest to be given in full as accurately expressing the views of one of the most reliable and intelligent mine owners. He says:

"I have been in this camp since its discovery and have charge of a group of quartz mines called the Takou Union Consolidated mines, situated about a mile and a half from Juneau City, at Saltwater Landing. We have four locations, all in a cluster, and in one hill which rises over one thousand feet above the level of the bay. Our development has so far been only to the amount necessary to perform the yearly assessment work.

"Capitalists do not feel inclined to take hold until we have some kind of civil government here. Although our mines prospect well, it requires capital to open them rightly and work them profitably. We have millions of dollars of hidden treasures in our hills, but it requires the assistance of capitalists to open the doors, and they are willing, but first ask for a civil government. So we will have to make ourselves contented by working surface placer mines until Government considers our situation. There are quite a number of quartz locations for about two miles up Gold Creek from our mines, all made before there were any placer mines discovered. The owners have not been able to do much more than simple assessment work, in such a manner that but a few thousand dollars have been realized directly out of the ledges. The surface, however, whether rightfully or wrongfully, has been located and worked by placer miners for some four months in the year, and paid remarkably well in free gold obtained by sluicing the dirt and decayed quartz. Some eight or ten companies perhaps average $20 per day to the hand. The placer ground so worked within the boundary lines of quartz locations yielded in all nearly $100,000, including those working similar ground on Douglas Island, two miles from Juneau, across the bay. Here is a large mine owned by Treadwell & Co. They have a little 5-stamp mill to prospect and work part of the ore as taken from the drift or tunnel. The probable result for the year 1883, ending in January, is about $8,000 or $10,000. The company have a tunnel across their ledge over 100 feet, and, as yet, no wall rock. This mine has been worked by a placer mining camp which in two seasons cleaned up about $20,000.

"The ledges run nearly northwest and southeast, and the country formation is slate. The climate is favorable for working quartz mines in this country all the year round."

Mr. Karl Kochler, of Juneau, estimates the product of the placer mines in that district at $150,000 for the year 1883.

Mr. Paul Schulze, of Portland, Oreg., president of the Northwest Trading Company, whose stations are all through Southern Alaska, estimates the gold product from the placers this year at $180,000, judging from indirect testimony from his agents.

The Rev. Shelden Jackson, in his addresses on Alaska, states that $300,000 in gold was taken from the mines; although the estimates furnished by correspondents are much higher than this—two of them being $400,000 and one $450,000.

From the amount of gold received at the San Francisco mint, I am inclined to believe that the production of the mines in Alaska did not amount even to $300,000; but there can be no certainty in regard to the amount produced, on account of the reticence of the miners as to the value of their claims and their ignorance of the amounts which have been cleared from a season's labor, and the frequency of shipments by private hands. A few of the miners send the dust or bars below by express, but the greater number of those working the placers save their gold until the close of the mining season and carry it themselves to the refineries, thereby avoiding the payment of express or other transportation charges. I have not felt at liberty to place the production above $300,000.

*Stickeen and Cassiar districts.*—Placer mines were first discovered and worked at the mouth of the Stickeen River, in Southeastern Alaska, and as early as 1862 miners were at work on the bars and at the mouths of the creeks and ravines emptying into the river.

Prof. William P. Blake, in company with a party of Russian naval officers, visited these gold fields in 1863, and in his report considered them as the natural continuation of the gold-bearing fields of California, Oregon, and British Columbia. During his explorations he invariably found the color by panning the drift of the bed and bars of the river, but the flour gold thus obtained was in particles so minute as to be difficult to see and more difficult to save. The best results were obtained in layers of gravel one and two feet below the surface, and the ground became richer as the river fell. In 1863 the average yield on the bars of the Stickeen was from $3 to $10 per day to the man. In his report he says:

"East of the islands and in the range of mountains of the mainland the rocks are in mica, slate, gneiss, and granite, and are traversed by quartz veins, which are presumed to be gold-bearing. However this may be, it is certain that extensive sources of gold exist in the interior, for the sands of the streams that descend to the coast all contain gold.

"Gold has for many years been known to exist upon the Stickeen, the Takoo, and the Nass Rivers. It has since been reported from many other places, widely separated. Upon the Stickeen considerable mining has been carried on by both United States and English miners who followed the gold-bearing zone from Frazer River northward.

"It is to these miners that we are indebted for the discovery of the metal in paying quantities upon these streams, and for much of our geographical knowledge of the interior.

"There is every reason to believe that this gold region of the interior extends along the mountains to the shores of the icy sea, and is thus connected with the gold regions of Asia.

"At the time of my visit to the Stickeen River, in 1863, an account of which is annexed, there was conclusive evidence of the existence of a gold field of considerable extent in the so-called 'Blue Mountains,' at the source of the rivers mentioned. It is probable that there are zones of gold-bearing veins in those mountains which supply the gold to the detritus of the rivers."

At Shuck's, on United States territory, 70 miles from Fort Wrangell, at the mouth of the Stickeen River, placer mining has been successfully conducted for several seasons by small parties of miners, and rich veins of quartz have been found which have supplied the drift found in the ravines and along the creeks. As many as three hundred men worked the placers at Shuck's each season, taking out $50,000 in all, but they are now mostly abandoned or worked by Chinamen. The gold obtained was in light scaly particles like that of Frazer River. At Shuck's the mining season was very short, water freezing in the boxes in September, and the ground on the sunless side of the valley being permanently frozen.

Of all this part of the Stickeen River country which lies within the United States boundaries almost nothing is known.

The Cassiar mines, the rich gold fields which Professor Blake believed would be found at the headwaters of the Stickeen River, were discovered in 1874 by one Thibert and a companion, who left Minnesota three years previously and trapping and prospecting their way across at last found these rich deposits.

The Cassiar mines lie within British Columbia lines, at a point 300 miles from Fort Wrangell, at the mouth of the Stickeen. The trade and business of the region center at Fort Wrangell, where passengers and merchandise are transferred from the ocean steamers to the small stern-wheel steamers that ply to Glenora, at the head of river navigation, 150 miles inland. River freights to Glenora are from $40 to $80 a ton, and the pack-train charges for conveying goods over the 150 mlies of steep mountain trail are equally excessive.

The mining season in the interior, where the weather is more severe than on the coast, lasts from May to October, many going up on the ice in February and few remaining after October, when the deep snows and intense cold of the interior prevents all placer operations. The miners winter at Fort Wrangell, or at the large cities and towns on the Pacific coast. Much of the gold from this region reaches the hands of Fort Wrangell merchants, and is by them shipped to Portland or San Francisco, but the greater part of the Cassiar gold is taken to Victoria.

Each year the value of goods imported for mines is between $400,000 and $500,000.

Since their discovery in 1874 the record of the Cassiar mines has been as follows:

| Year. | Number of miners at work. | Product in gold. |
|---|---|---|
| 1874 | 2,000 | $1,000,000 |
| 1875 | 800 | 1,000,000 |
| 1876 | 1,500 | 556,474 |
| 1877 | *1,200 | 499,830 |
| 1879 | 1,800 | |
| 1880 | | |
| 1881 | | |
| 1882 | | |
| 1883 | 1,000 | 135,000 |

* One-third Chinese.

In the fall of 1883 many miners abandoned the region, as the placers are becoming exhausted, and machinery and capital are needed to work the rich quartz lodes which have been discovered.

The difficulty and expense of reaching these mines will prevent their further development, and it is hoped that the growth of the mining region at Juneau, on United States soil, directly west of the Cassiar, will help the construction of a short road across the country, which will make the mines more accessible than by the dangerous river navigation and long mountain trail.

*Sitka mining district.*—In 1871, one Doyle, an experienced prospector, and at that time a soldier in one of the artillery companies stationed at Sitka, found float gold at the mouth of the creek on Silver Bay, where the Russian engineer had found it previously. Following up these indications he found the first quartz ledge on the slope of Round Mountain.

In 1872, Doyle and another soldier, Frank Mahoney, went on a prospecting trip to these mountains to secure more specimens from this ledge, now known as the Haley and Milletich. When exhibited these specimens attracted the attention of Nicholas Haley, who, having mined in Nevada, considered the specimens of sulphurets valuable, and organized a prospecting party. After clearing away the trees and sod, the ledge appeared "11 feet wide, between well-defined slate walls, trending northwest and southeast, and having near its center a seam of iron sulphurets about a foot wide." Haley fired the first blast in Alaska quartz veins, and $80 in free gold was obtained from the rock thrown out and broken up.

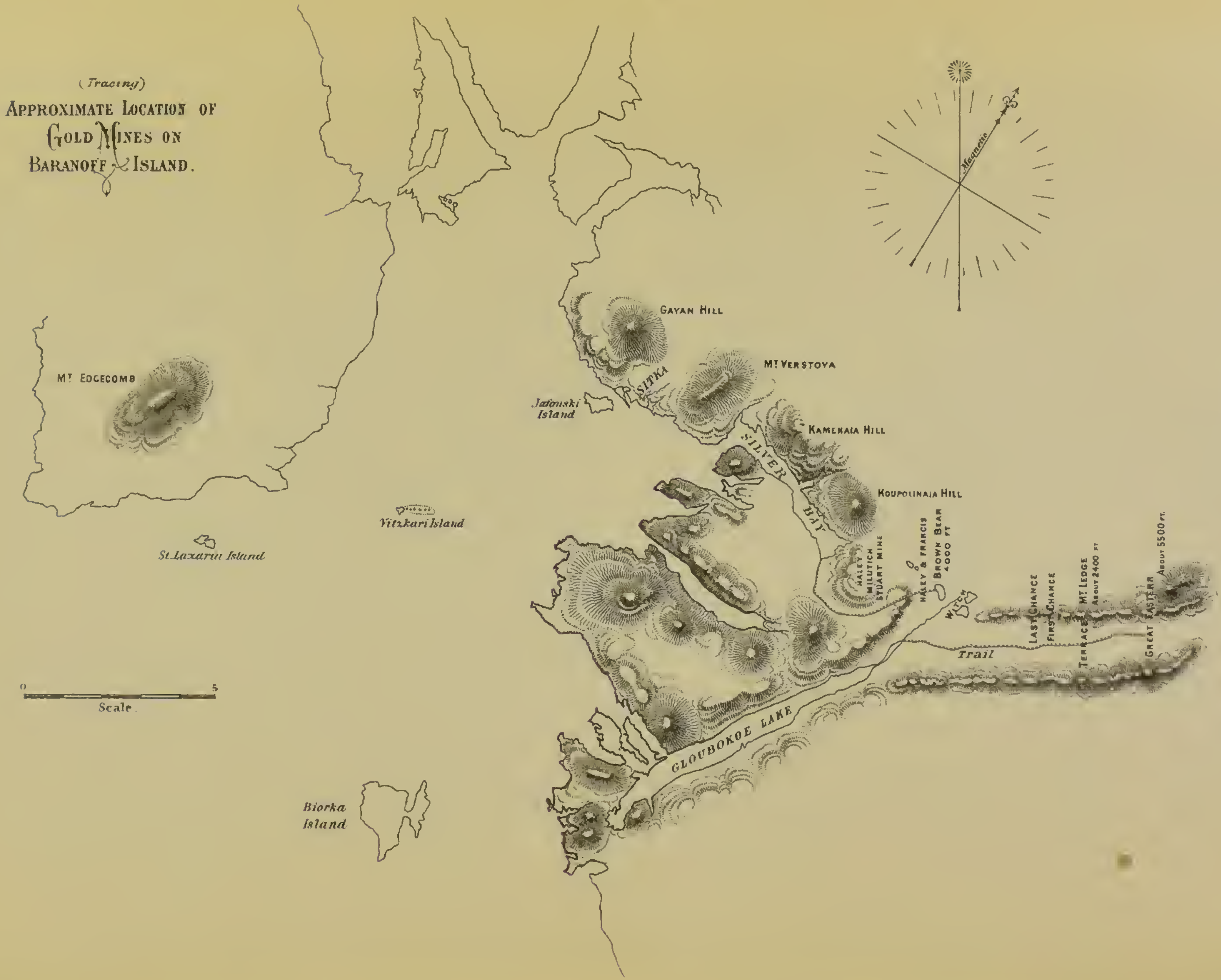
Doyle later found a narrow stringer of quartz on the banks of Indian River, at or near Sitka, but after working this outcropping for a short time it was abandoned.

Other ledges were discovered on and near Round Mountain by this same company of prospectors, and in 1877 a San Francisco firm bought the Stewart ledge and organized the "Baranoff Island Gold and Silver Mining Company." The capital was $1,000,000, in shares of $100 each, Haley and Milletich receiving one-third of the stock.

This Stewart mine has had many vicissitudes, has changed hands many times, and is now owned by the "Alaska Gold and Silver Mining Company," incorporated at Portland, Oreg., January 30, 1877; capital, $300,000, in shares of $1 each. Soon after this Mr. C. L. Walter, a mining engineer, was sent to examine the property. In his report he says:

"This mine, commonly called the Stewart tunnel, is situated about 14 miles southeast of Sitka, 800 feet above the level of the sea, and about a mile and a quarter from deep water, where the largest ship may come in safety. The ledge is well defined, runs east and west, and is about 15 feet wide, with a fissure vein from 3½ to 4 feet in width. The rock is bluish gold-bearing quartz, and lies in a slate formation between a good foot and hanging wall. About 250 tons of rock have already been taken out, averaging from $12 to $15 a ton, some of which, however, runs as high as $30 to $35 a ton. The rock will have to be crushed by the wet process, concentrated, and sulphurets roasted and passed through chloridation, in order to separate the gold from the sulphurets. This process costs $4 a ton, and will leave a fair profit. The tunnel has been run in 106 feet, and has cut through two bodies of fine ore, the first body being 60 feet long and the second 17 feet long.

"These two bodies are about 9 feet apart, with good tracings between them, showing that both bodies are coming together at a short depth which will give a slope of 86 feet. Three shifts of men were kept a



(Tracing)
APPROXIMATE LOCATION OF
GOLD MINES ON
BARANOFF ISLAND.

work night and day in order to sink the shaft. When this is opened, a 20-stamp mill can be kept constantly working.

"Water-power sufficient to run an 80 stamp mill can be had at an expenditure of $400. A tramway has to be built a mile and a quarter in length, for the purpose of carrying machinery, &c., to the mines, and will cost from $1,400 to $1,600."

A 10-stamp mill was built on this property and three tunnels in all were run, and a furnace was provided for roasting the sulphurets. In eleven days it once produced $1,800, but after many difficulties among the stockholders, the company became bankrupt, and the works were abandoned and are still idle.

The same Nicholas Haley later discovered the Witch, a pocket mine which has furnished large nuggets of free gold. In 1880 Haley and his family obtained an ounce of gold daily, by crushing the decomposed quartz in a mortar, treating with mercury and obtaining free gold only by this rude process. Five pounds of rock taken at random by a visitor produced 34 grains of gold.

Other mines discovered at about the same time as the Stewart were the Witch, the Great Eastern, the Bold Mountain, North Star, Juno. Henrietta, Burning Moscow, Brown Bear, and Francis.

A permanent organization of the miners was effected in April, 1879, The mining records are kept at the Castle, and all mining claims, mill-sites, portages, landings, trail claims, water sites, water frontage, town sites, &c., are duly entered.

The metes and bounds of the Sitka mining district are described as follows: "Bounded on the north by latitude 57° 10′; on the south by latitude 56° 40′ in Whale Bay; on the east by the west shore of Chatham Strait, and on the meridian of Katlèani Creek at its mouth."

Since this time other discoveries have been made, but the want of a civil government has deterred any one from risking the capital necessary to develop these mines.

On Baranoff Island there are now twelve known veins of gold-bearing quartz uncovered, assaying from $12 to $500 a ton. All are in slate formations and two veins are rich with tellurides. The black sulphurets are rich and easily reduced. A lode at the base of a mountain can be traced up its sides, distinctly cropping out all along to a height of 3,000 and 4,000 feet. The glacial formation is plainly shown, and often on the summits of the mountains there are found rich deposits in old moraines.

On Mount Edgecumbe, opposite Sitka, a vein of gold and silver bearing quartz has been found. It lies in a granite formation and assays at $300 per ton. Its location is accessible and near a good harbor, but no efforts have been made to work the property.

A letter from Nicholas Haley speaks of his ledge on Round Mountain as being 14½ feet wide ribbon rock, similar to the Eureka mine in Grass Valley, Cal. The Lucky Chance mine he considers very rich in free gold and the sulphurets yield $18 and $40 per ton. Rock from the drift has assayed into the hundreds and specimens of it have been sent to Philadelphia. The walls of this mine are decomposed talcose slate, in a good solid formation.

*The Berry mining district.*—This mining district was the second organized in Alaska, and was named for Maj. M. P. Berry, formerly collector of customs at Sitka. Its boundaries are as follows:

Beginning on the north in latitude 58° 50′; east by the Lynn Channel; south by latitude 58° 14′, and west by the Pacific Ocean. Richard Willoughby is recorder, with headquarters at Tchsish or Sherman

Island, but in the winter the records are kept at the Hoonah village, at the office of the Northwest Trading Company. Silver ore and gold quartz have been found on Tchsish Island, but only placer work has so far been done.

*Sum Dum and other placers.*—Professor Muir visited Sum Dum Bay in 1879, and at Shough, a camp in a valley at the head of the inlet, found miners at work, in the most primitive way, with rockers and sluices. These mines were discovered in 1876, and were the first placers worked in Alaska. In 1880 they yielded $10,000, and the amount of gold-bearing gravel in this basin seemed inexhaustible.

No large camp or organization of miners has existed, and it is impossible to learn anything more recent than the statements of Professor Muir. Sum Dum Bay is an indentation of the mainland on Stephenson Straits, a hundred miles south of Juneau.

At Glacier Bay, 100 miles north of Sitka, there are indications of an extensive silver belt, and carbonate of lead, sulphate of lead, carbonate and sulphate of barite, and other formations, have been found. Very little prospecting has been done in Glacier Bay.

*Harris mining district.*—After Professor Muir had examined the coast region of Southern Alaska in 1878–'79, and visited the mines near Sitka, he announced it as his belief that richer gold deposits would be found on the mainland, not far from Sitka, and that the true mineral belt followed the trend of its shores. His forecast was proven in the following year. The Indians had several times brought in very rich specimens of float gold to show to the commander and officers of the U. S. S. Jamestown, then stationed at Sitka. Finally, having shown some unusually fine nuggets and quartz specimens, a prospecting party was organized to search the shores of Gastineaux Channel, 100 miles northeast of Sitka, where the Indians claimed to have found these specimens. This party, headed by Joseph Juneau and Richard Harris, reached Gastineaux Channel October 1, 1880, and camped on the present site of the town of Juneau.

Three large creeks empty into the channel within a reach of a mile, and the indications of gold were found on the banks of all of them. The first creek to the south is Sheep Creek; a half mile west of it is Gold Creek, where the richest claims lie; and a mile and a half beyond is Salmon Creek, which is full of very rich float rock.

Juneau and his men followed up Gold Creek and its southwest branch for about four miles, and in a valley surrounded by mountains rising abruptly 3,000 and 4,000 feet found very rich croppings of quartz. He found other ledges and rich placers in the gulch below, and from evidence believed that a rich mineral belt a half mile in width extended for some distance through the mountains. They returned to Sitka with several sacks of specimens and immediately a stampede resulted; every boat, canoe, and conveyance was used, and in December the camp was established, and a new town sprang up. The adjacent mountains were prospected and richer ledges were discovered. Placer claims were located along Gold Creek and in the valley at its headwaters, since called Silver Bow Basin. Later, to the great surprise of geologists, the great quartz ledge on Douglas Island was found, a ledge said to be over 650 feet wide, and as large as the Comstock lode.

Harris took up a town-site and 160 acres of land, and in the spring of 1881 miners flocked to this new gold region. Among them were many of the pioneer prospectors of Tombstone and other Arizona mining districts, and a detachment of marines from the Jamestown was encamped there to preserve order. The camp was then called Rockwell, after one

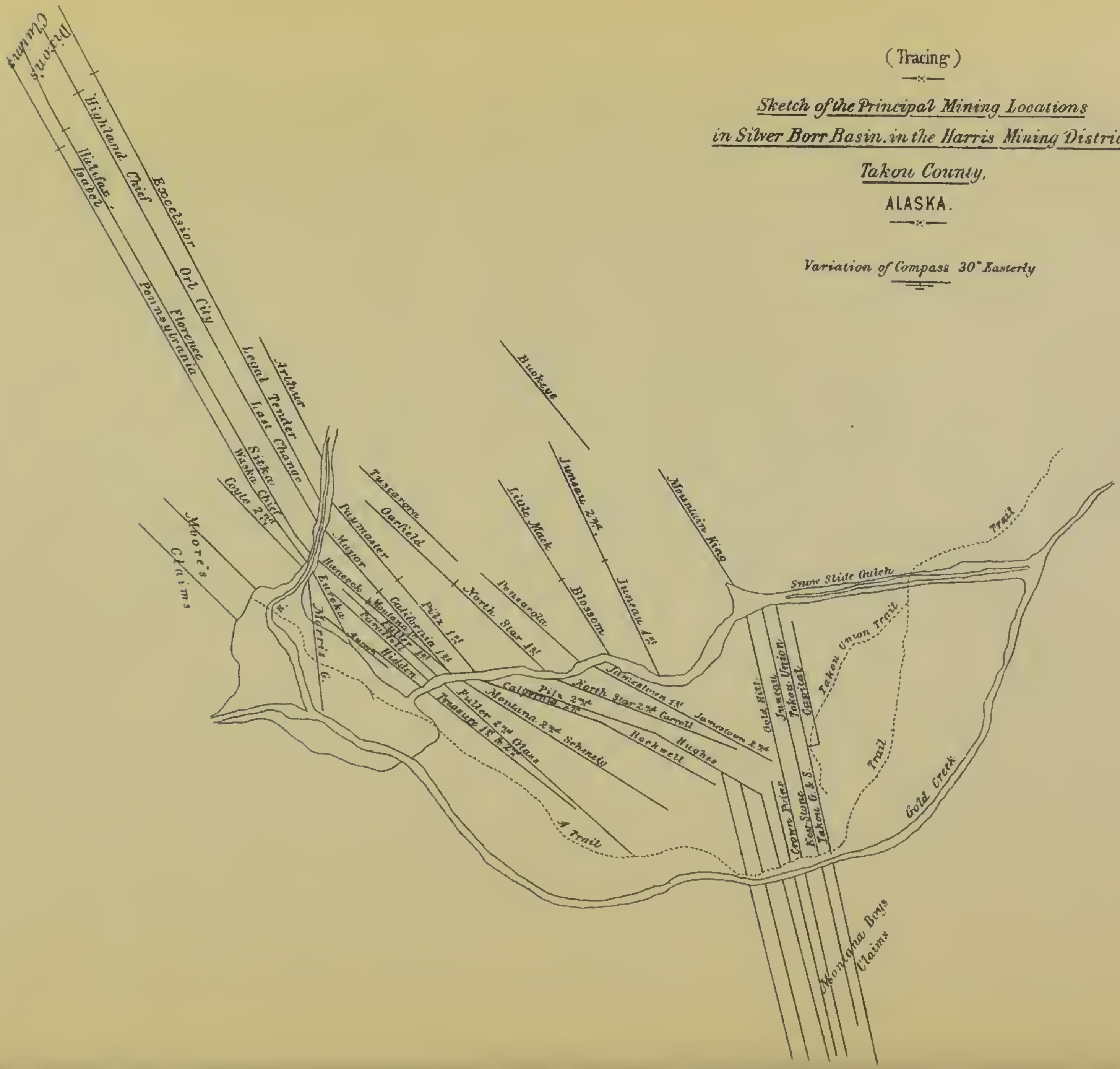
(Tracing)

## Sketch of the Principal Mining Locations in Silver Borr Basin. in the Harris Mining District.

Takou County,

ALASKA.

Variation of Compass 30° Easterly



of the junior officers of the Jamestown. During this year a post-office was established and $60,000 in gold dust was shipped south by the mail steamer. In May, 1882, the miners held meetings and formed an organization, and the town which was previously known as Takoo, Rockwell, and Harrisburg, was renamed Juneau City, in honor of Joseph Juneau. Chinamen were warned to leave the camp, and notice was given that no more Celestials would be allowed to land. In March of that year the first quartz mill was brought up and landed on the Treadwell claim on Douglas Island, and in May the sound of dropping stamps was heard. Placer mines during 1882 yielded daily from $20 to $40 per man, and from these washings $250,000 is said to have been shipped. Five hundred miners were at work prospecting and digging.

The partners Juneau and Harris cleared up 95 ounces of gold dust from nine days' work by five men, and Dickson & Co. began running a ditch 1¼ miles long from the head of Gold Creek to Specimen Gulch. The Webster mill, on Gold Creek, began work in August, and was run night and day, a great deal of custom work being done. Prospecting was carried on and experts made a partial examination of the valleys lying back from the coast. More discoveries were made in Silver Bow Basin, which is at the head of Gold Creek, and 3 miles back from the settlement. The basin is but 1,500 feet above tide-water, but to reach it the trail crosses a divide 3,500 feet above sea-level. The trail, which is 3 miles in length, is almost impassable during the mining season, on account of the sand, and as there are no carts or horses in this part of the Territory, provisions and ore have to be transported on the backs of Indian carriers, who charge exorbitant rates.

The placers in the basins are on the hillsides, and are worked by ground-sluicing on the quartz ledges, and the deposit is decomposed quartz and gravel, carrying small grains of rough gold more or less coated or rusty. The water for working them is furnished by melting snow and a stream flowing from a large glacier in one of the ravines. The miners have boxes from 60 to 100 feet long, and save the gold by quicksilver; a few hydraulic nozzles have been used at the placer claims. Six true lodes of auriferous quartz in metamorphic slate were found imbedded between secondary granite and basaltic rock, and carrying black sulphide of silver. The lowest assays of this quartz yielded $150 per ton, and several specimens gave $3,500 per ton.

*Dix Bow Basin* lies just over the range, a mile distant from Silver Bow Basin, and the Dix Bow ledge is apparently the same as that of the larger valley. George M. Pilz, a mining engineer, gave in 1882 the following report of the Silver Bow Basin mines of the Harrisburg district near Juneau:

"The geological formation of the quartz ledges are four fissure veins of auriferous quartz, carrying galena and selenite of lead and arsenical sulphurets of iron. The mineral belt is from 1½ to 2 miles in width. There are apparently eight main ledges and a number of smaller parallel veins from 10 to 30 feet apart. On most of the main ledges from ten to twelve locations have been made, each 1,500 feet in length. The foundation of the mineral belt is a metamorphic slate, the ledges being incased in manganese slate, which forms the gangue of the ore-bodies and carries considerable of the precious metals. The north wall of this mineral belt is a primitive granite, forming the summit of the coast mountain range with an altitude of 4,000 to 6,000 feet.

"This part is unexplored. The south wall of the mineral belt is a syenitic gneiss, intermixed with basaltic slates. At the contact of the south wall and mineral belt runs a large lode of felsite of low-grade ore, which is apparently the northern belt.

"The quartz locations are at an altitude of from 700 to 3,500 feet above the level of the sea, and from 1½ to 4 miles from the shore of Stephenson's Straits. The quartz ledges are from 2 to 20 feet wide, generally from 2 to 5 feet, and are visible on every claim so far made, showing regularity and continuity; and the surface wash from these ledges, which have been worn down considerably, apparently through former glacial deposits, will pay on the hillsides, under the ledges, from $3 to $20 per day to the man. The ledges are but little developed, the deepest opening being about 30 feet, but nature has cut them pretty deep in gulches and ravines."

The articles of incorporation for the following mines situated in Silver Bow Basin, near Juneau, were filed in San Francisco, February 19, 1881, but were not published until 1882. Nearly all now are under the same ownership, and a first assessment of 1 per cent. was levied in February, 1882, for the payment of necessary expenses attending organization and to provide for the annual work required by United States statutes to perfect the title to mineral claims. The mines thus assessed were, the General Miller, capital $5,000; Jeannette, capital $5,000; Jamestown, capital $5,000; Maryland, capital $5,000; Czar, capital $5,000; Bryant, capital $5,000.

The Bullion mine was successfully worked in 1882, and the North Star Mining Company began operations by putting a tunnel 126 feet into their ledge.

In 1883, 200 miners were at work in the Silver Bow Basin. At the Webster mine the 5-stamp mill was at work night and day, reducing its own ores and doing custom work. Hydraulic and placer claims were being worked, and Hilton had several roasters treating the sulphurets with success. In June the mail steamer carried down $60,000 in gold dust. This summer there were not more than 500 inhabitants at Juneau, but in the winter the population is doubled by the return of the prospectors and miners from distant claims.

One hundred and fifty miners were at work in Silver Bow Basin, and quite a settlement was made.

## MINING LAWS OF THE HARRIS DISTRICT, ALASKA.

Whereas valuable mines have been discovered by Richard Harris and Joseph Juneau on the mainland of Alaska during the month of October, 1880, and no legal code of local laws having been made, the miners residing near these discoveries now think it prudent to have a code of local laws in accordance with the custom of miners and the laws of the United States, and do now enact the following articles:

### ARTICLE 1.

This mining district shall be called the Harris Mining district, and its boundary lines shall be as follows: Commencing at the Auk Indian village and running northeast true to the boundary line of Alaska and British Columbia; thence along said boundary line to where it intersects the Takoo River; thence down the Takoo River and Takoo Inlet to Stephens Passage; thence along Stephens Passage to point of beginning.

### ARTICLE 2.

Claims shall be divided into four classes, viz, placers, vein or lode, mill-sites, and water-privileges.

## ARTICLE 3.

SECTION 1. Placer claims shall be subdivided into three classes, viz, creek or river, gulch or ravine, and hill claims.

SEC. 2. Creek or river claims shall be 200 feet in length, and shall extend from rim rock to rim rock in width.

SEC. 3. Gulch or ravine claims shall be 200 feet in length and 100 feet on each side of the center of the gulch.

SEC. 4. Hill claims shall be 200 feet in front, commencing where creek or river claims leave off, and running back to the summit at a distance not exceeding 1,000 feet.

SEC 5. Each discoverer of new diggings shall be entitled to 200 feet by pre-emption in each river, creek, or gulch or ravine that he or they may find gold in paying quantities, provided the number is not to exceed four.

SEC. 6. A miner is entitled to hold, if *he* represents, according to the laws of the district, one river or creek claim, one bench or hill claim, and one gulch or ravine claim, by pre-emption, on each creek or river in the district. A miner can locate ground for not more than two *bona fide* partners, and they must be residents of the district at the time of location.

SEC. 7. All claims shall be distinctly marked, by placing sticks at each corner and giving such description, by referring to some natural object or permanent monument, that the claim can easily be found, and its boundary lines readily traced.

SEC. 8. No person or company shall be allowed to dump tailings or other *débris* on the adjoining company's ground without the consent of said company, and each miner or company shall be entitled to drainage through the adjoining ground.

SEC. 9. The working season shall be from the 1st day of June to the 1st day of October. All placer claims must be represented during this time unless just reasons can be given for laying over claims, as provided in these articles.

SEC. 10. Placer claims may be laid over during the working season for the following reasons: Sickness of claimant, lack of water, or continued heavy floods in the river. Where a claim is laid over the claimant must place a notice on the claim stating the cause of laying over, and must file a duplicate of the same with the district recorder.

SEC. 11. All placer claims that have been duly represented during the working season are laid over from the first of October until the following June.

SEC. 12. All disputes concerning placer ground may be settled by arbitration.

## ARTICLE 4.

Vein or lode claims shall be located and worked in accordance with the mining laws of the United States.

## ARTICLE 5.

Mill-sites shall be located on non-mineral lands according to the laws of the United States.

## ARTICLE 6.

Water privileges may be located, but such location shall not conflict with the interest of river miners.

### ARTICLE 7.

A recorder shall be elected annually by the resident miners of the district. It shall be his duty to keep a time record of all locations of claims, transfers, or lay-over notices. The records shall be kept in the most settled part of the district and open for inspection.

### ARTICLE 8.

Vein or lode claims shall be recorded within twenty days after location, and placer claims within ten days after location.

### ARTICLE 9.

The recorder's fees shall be $1.50 for each record of placer claim, transfer or lay-over notice; and $2.50 for each record of vein or lode claim, mill-site or water privileges, or transfer of same.

### ARTICLE 10.

A miners' meeting can be called by the recorder of the district at the request of twenty or more miners, but he must give at least ten days' notice, and said notice must be posted in at least three conspicuous places in the district.

Adopted at Harrisburg, Alaska, February 9, 1881.

*Douglas Island district.*—As stated, the Douglas Island placers and quartz lodes were discovered soon after those on the mainland, and the first camp was located in 1881. The limits of the district organized comprises the island, which is 20 miles long and 7 and 8 miles wide, and separated from the mainland by Gastineaux Channel. A townsite was located and called Cooperstown, and richer quartz lodes were found. The first great mine, the Paris or Treadwell, has been regularly worked by a company of San Francisco capitalists by means of a 5-stamp mill, built in 1882. A lawless body of men have for two seasons been working placers on the surface of the lode, and as there is no power to appeal to, the Treadwell company is forced to endure this condition of things. During the summer of 1883 it is estimated that $25,000 were washed from the surface of the ledge. These placer miners pound up the rich decomposed quartz in hand-mortars, and they have been dumping over into the channel richer quartz in many instances than has been worked in the Treadwell mill, as it is impossible to extract all the gold by the rude hand process. This deposit of decomposed quartz on the top of the ledge is often 10 feet deep, and in working it the placer miners took all the water from the Paris, or Hays Creek, and shut off the Treadwell mill entirely. The contest between the mill owners and the hydraulic miners was only settled by an appeal to Captain Merriman, commanding the U. S. S. Adams, who went over from Sitka, in September, 1882, and heard the complainants. An agreement was finally drawn up in his presence by which they pledged themselves, "until such time as they should have civil law," to let John Treadwell have the water of the creek during the night, or for twelve hours of each day. For the other twelve hours, or during the day, the placer miners were to have the use of the water; and they also agreed not to blast the lode, but only to wash the surface ground.

In November, 1882, Mr. Robert Kelly, a mining expert and engineer, visited this property, and his report, being unusually full and complete, will probably give the best idea of the character of the mines near Juneau. Mr. Kelly says:

"The Paris or Treadwell mine is located on the eastern side of Douglas Island, and the lode is traced for a distance of 1½ miles, its strike being southeast and northwest, and nearly parallel to the course of Gastineaux Channel. It conforms in its dip and strike to the stratified country rock, which is slate. The vein is situated on the eastern side of a range of hills which are of a conical form. These hills are not connected with and do not form any portion of the ribbed, denuded, and irregular-shaped granite mountains, and its spurs, which constitute the higher and interior portion of the island, and which trend at varying angles to the mineral-bearing slate belt.

"The Paris mine has an eastern dip of 60° and a width of outcrop of at least 550 feet, and the deepest point to which the vein is exposed is at the hanging wall on Paris Creek, which is 250 feet perpendicular measurement below the top of the vein on the mesa on either side of the creek on the line of the hanging wall. The hanging wall of the vein is 26 feet thick. In contact with the quartz and with little clay between there are 6 feet of silicious slate imperfectly stratified, and between the silicious slate and the country rock there are 20 feet of greenstone which marks a well-formed hanging wall. On the foot wall no trap rock appears, and the wall is but little changed from the country rock. The slate in contact with the quartz has for a few feet a darker color, with a thin sheet of plumbago-looking clay between. After the clay is removed a well-polished slate wall with slight grooves and scratches is exposed. The stratification of the quartz is not regular. There are, however, a number of seams at irregular intervals of 5 to 20 feet apart that are parallel to the dip of the walls, and between these seams the stratification is very imperfect, and generally dips at an angle of about 40° towards the foot wall. Within 6 feet of the foot wall the quartz is of the banded form and dips with the wall of the vein. All of the vein matter from the foot to the hanging wall is ore, with the exception of 25 feet in width of slate that crops out near the center of the vein. Paris Creek has cut down through this wedge of slate so that the course of the creek can be followed from the hanging to the foot wall, the whole distance being ore that varies but little if any in appearance. There is no horse or barren zone in the vein. Every pound of rock between the walls will assay something, the very poorest not less than $2 or $3 per ton. A considerable portion of the ore has a feldspathic cast, and strange as it may appear, often where the feldspar shows the most the ore is the richest. The ore when taken out has a bluish cast, but when dry it decomposes very rapidly and changes to a light-gray color. The ore is neither very hard nor soft. It is compact, rather brittle, and breaks well, and nearly all of it will require power to remove it.

"The first work of any importance that was done on the mine was the running of tunnel No. 1, which is in 40 feet and all in quartz. This tunnel will have to be run 40 feet farther before striking the foot wall at a depth of 60 feet from the surface. Samples of ore taken from different parts of the tunnel and tested and worked in San Francisco at different metallurgical works gave results of $5 to $16.32 per ton, and the concentrations assayed from $37 to $175 per ton.

"Tunnel No. 2 is run 140 feet to the foot wall and all its length in ore, the end of the tunnel 125 feet below the surface. There were only 50 tons of ore milled from the first 30 feet of this tunnel, that paid $3 per ton in free gold; then the placer miners took the water, which prevented the mill from running. The average of assays made from this tunnel later was $10 a ton in gold; this, of course, including sulphurets.

" Tunnel No. 3 was run in only 12 feet and assayed only $3 per ton, and out of 20 tons of the ore milled from it only $18 was obtained. This ore is the hardest in the mine, and the tunnel was run in on the edge of the creek.

"About 200 feet to the south, and up the hill from the tunnel, 100 tons of ore yielded $650; and about 200 feet farther up and west 70 tons yielded $450, and 50 tons $526. These lots of ore were milled in the 5-stamp mill at the mine, and nothing but the free gold saved. From the ground or quartz washed off the surface of the vein $54,000 was received, at a cost of about $6,000. The projected 530-foot tunnel will have to be run through the country rock and hanging wall for a distance of about 90 feet, when it will cut the quartz at a depth of 60 feet. The tunnel can then be run through the ledge a distance of 420 feet, when it will strike the foot wall at a depth of 260 feet below the surface. In these estimates the south extension, which is 1,000 feet in length on the vein, is not considered; therefore the question of the quantity of ore need never be raised. As near as I can approximate, there is 3 or 4 per cent. of the sulphurets of iron in the ore which contain about $4 per ton in gold. The sulphurets are worth about $100 per ton. It would require the most improved machine to do the concentrating.

* * * * * * *

" The hanging wall of the mine is 700 feet from the beach of Gastineaux Channel, where, within 300 feet of high-water mark, there is 50 feet of water. There is a good mill-site in Paris Creek between the mine and the beach, and for seven months in the year not less than 200 inches of water flows into the creek, which is owned by the Paris Company. Three hundred and fifty feet of head can be had without any expense except what 1,200 feet of 22-inch pipe would cost. For the other five months in the year the motive power would have to be steam, and the whole of the slate belt on Douglas Island, as well as on the mainland and islands near the water's edge, is thickly timbered with trees from 10 to 36 inches in diameter. These are mostly spruce and hemlock, and will answer all purposes of mining, but are only ordinary fuel for steam producing. It is furnished by the Indians for $2 per cord. On the other side of the island there is a large quantity of yellow cedar, which is good for either fuel or timber.

" On Admiralty Island, which is separated from Douglas Island by a channel 2 miles wide, there are a number of coal seams or veins, but little or nothing has been done to test them. Coal from Puget Sound can be delivered at the Paris mine for $8 per ton.

* * * * * * *

" I will place the mining at 70 cents and the milling at $1 per ton, or $1.70 as a total cost. I cannot see why the mining should not be done for 40 cents a ton, as there is scarcely any dead work and no pumping, and the ore can be taken out in a face as in a quarry, where no timbering is required, nor will be required for a lifetime. The climate through a portion of the spring and summer months is very wet, a great deal of rain falling The fall months are pleasant and through the winter there is considerable snow. The placer miners stopped washing December 5, 1882, and on December 24 the thermometer stood at 36° or 4° above the freezing point. While the seasons are not agreeable, there is nothing to prevent a continuous working of the mine.

"In the fall of 1882 Daly, an old prospector, found a new lead 1,000 feet wide on Douglas Island, and immediately three camps were established on it. In the following spring a 5-stamp mill was erected on this Bear ledge, and in one month (September) $25,000 was shipped from it.

"In 1883 the Treadwell cleaned up $9,000 in April, and the ledge, 500 feet in width, was stripped for 1,000 feet in length on top. In October 220 tons of ore were crushed, yielding $26,000 in gold without saving sulphurets, which average $5 to the ton. At that time they were running the fourth tunnel into the ledge, the last one being 500 feet below the surface, 100 feet across the ledge, with no wall rock. The value of the ore has been tested, not by assays, but by actual returns of a 5-stamp mill. The difficulty in obtaining lumber has been overcome by the erection of a saw-mill at Juneau. The placer miners located on top of the Treadwell or Paris ledge have taken out $25,000 during the past summer and dumped quantities of rich ore over the cliff into the sea. There is no possibility of dislodging them until civil law is established, and thousands of dollars in ore have been wasted by their careless mining. Other miners came in, and, scraping up the tailings from these placers that lie on the beach at the foot of the cliff, have made good wages by washing in rockers.

"The Ready Bullion claim, situated on the beach, paid for a time $20 per day to the man, but was soon exhausted."

*Montana, McGinnis, and Goat Creek placers.*—Northwest of Juneau, at the entrance to Lynn Canal, gold was found on Montana, McGinnis, and Goat Creeks. The prospectors found a large and well-defined ledge of high-grade ore, and the placer-miners soon began ground-sluicing the decomposed quartz on the ledges. The Telegraph and the Alexandre lode was traced for a couple of miles, its width varying from 50 to 100 feet.

*Yakutat.*—At Yakutat Bay, at the foot of Mount Saint Elias, black sand was found on the beach a year ago, and in June a party of 5 prospectors were taken there by the U. S. S. Adams.

*Copper River.*—A party of prospectors went to the mouth of Copper River in canoes during the summer, carrying supplies for one year, intending to prospect thoroughly and remain during the winter.

*Yukon district.*—Of the Yukon country more is known than of other and more accessible portions of Alaska. In 1865 the Western Union Telegraph Company sent out an expedition for surveying a cable route up the west coast of America and across Bering Straits and Siberia to Europe. The success of the Atlantic cable proved the futility of their scheme, and after two years' work and the expenditure of $3,000,000 the engineers were recalled and work abandoned. Professor Dall, of the Smithsonian Institution, and other scientists, accompanied the expedition. Much information was obtained by the several hundred explorers who examined over 6,000 miles of country from Frazer River to Bering Sea, and thence southward to the Amoor. Professor Dall and his party spent two years on the Yukon, ascending it from its mouth, and two of the company, Ketchum and La Barge, in 1870, ascended to the headwaters and found evidences of gold.

The vast extent of unexplored country in this northwestern part of Alaska has always been a temptation to pioneers. The headwaters of the Yukon are easily reached by a chain of lakes and short portages at the head of Lynn Channel, 100 miles north of Juneau. Until within these last two years the Chilkhat Indians of the coast would not permit any white men to penetrate to the interior, nor allow the Indians of the interior to come to the coast, lest the Chilkhats lose the control of

the fur trade. One of the earliest explorers of the Yukon was a Hud
son Bay Company trader, who ascended the stream, came out over th
Chilcoot Pass twenty years ago, and was taken from the Chilkhat In
dians by Captain Swanson, then in command of a Hudson Bay Com
pany steamer. After him George Holt, a prospector, crossed the Chi
coot Pass in June, 1872, or 1874, as some narrators give it. In th
chain of lakes above Lynn Channel gold was frequently found. Nea
the surface it was flour or scale gold, but in holes he found lump
ranging from 25 cents to $1. Continuing from that point he went dow
the Yukon to a point near its mouth, where there is a portage to th
Kuskokvim River, and down the latter stream to Bering Sea. A part
of miners from Sitka, led by Edmund Bean, attempted to cross th
Chilcoot Pass in 1877, but the Indians obliged them to turn back.

In 1879, aided by the clever diplomacy and active interest of Captai
Beardslee, of the U. S. S. Jamestown, Bean and his party of miner
succeeded in penetrating to the interior across this divide, but made n
important discoveries before the lateness of the season compelled the
to return. While crossing the divide they found indications of gold
The wash gravel consisted of slate, quartz, and iron deposits, while th
surrounding mountains were chiefly granite. They were unable to de
termine from which direction the deposits had been made. From Chil
coot Pass this party went down the river to Fort Selkirk and ther
divided, one party of prospectors going to Fort Yukon, and the other
up the Pelly River and thence to the headwaters of the Stickeen Rive

In the spring of 1882 a party of forty-five miners, all old Arizon
prospectors, left Juneau to prospect on the headwaters of the Yuko
They returned in November, 1882, and reported discoveries of gold
silver, copper, nickel, and bituminous coal in a region 150 miles east o
the Copper River.

In the spring of 1883 Dugan and party went from Juneau to prospec
at the headwaters of the Yukon. In September they sent back I
dians for an additional supply of provisions, intending to remain in th
interior all winter. They reported rich placers yielding $150 a day t
the man. Another party left Juneau soon after Dugan, and returnin
in September reported placers paying $25 a day.

In May, 1883, Lieutenant Schwatka, U. S. A., and party traverse
the same portages and divide, and went down to the mouth of the Y
kon on rafts, and have not yet reported any mineral discoveries.

More than two hundred prospectors in all crossed from Lynn Chann
by way of Chilkhat River and portage of 24 miles to the chain of lake
from which a river empties directly into the Yukon. The coast India
control the travel in the region, charging $6 a hundred pounds f
packing goods across the portages, furnishing canoes and guides. O
party of miners lost their boat and provisions and succeeded in reac
ing the missionary station at Haines in a starving condition.

The largest and best equipped prospecting party that has yet unde
taken the exploration of any part of Alaska left San Francisco in Ju
1882. The party was organized by Edward and Eff. Schiefflin, disco
erers of the Tombstone mines of Arizona, with intention to prospect
the Yukon River. The existence of gold on that stream and its trib
taries had long been known, and the Indians had often brought in ri
specimens to the agents of the Alaska Commercial Company, whi
has trading posts on the mainland of Alaska as well as on the Se
Islands. The Schiefflins built for themselves a small stern-wh
steamer for navigating the river, and chartered a schooner to ta
them to Saint Michael's Island, near the mouth of the Yukon.

Edward Schiefflin, the leader of the expedition, is a practical and experienced miner, used to rough frontier adventure, and he followed the theory that there was a great mineral belt encircling the world from Cape Horn to Siberia. He expended over $20,000 on the outfit, including tools, weapons, miners' supplies, and provisions for three years. They started from San Francisco in June, 1882; reached the island of Saint Michael's the last of July, and on August 1 embarked on their little steamer (the New Racket) and went 800 miles up the Yukon to their winter quarters at Nuklukayet at the mouth of the Tananah River. At a point 300 miles from the coast they found a narrow belt of mineral-bearing formation. Eighty miles beyond Nuklukayet, in a range of mountains, they found small rivers, creeks, and gulches, where prospecting revealed places that would pay $10 a day. There were many indications of a large mineral belt running through these mountains. Each pan of dirt showed heavy, regular lead gold, and smooth-washed gold was found in the loose gravel. In the spring of 1883 they started up the river and found placers paying from $10 to $15 a day at a point called Rowetka.

In August the rest of the party sold out their interests in the steamer New Racket to Charles Fairchoit, the engineer, and returning to Saint Michael's, were brought to San Francisco by the revenue-cutter Corwin. Fairchoit chose to remain there alone rather than abandon the explorations, as he felt convinced that a richer mineral belt than any yet found exists in that region. With the steamer New Racket he has a small canvas canoe fitted with boilers, and in this he will explore the smaller streams. He has provisions sufficient to last three or four years, and proposes to remain until they are exhausted.

Schiefflin brought back with him much scale and rust gold washed from the placers, and found barren white quartz, but no ledge, although the float gold from it was abundant. Owing to the long winters and the difficulty of obtaining provisions, tools, &c., he does not think that mining in that northern part of the Territory will pay.

It requires the working season of one year to reach the placers that he found, and prepare for work. The three months of mining are succeeded by nine months of idleness. He is convinced that the American mineral belt crosses to Siberia at a point lower down, and he abandons the Yukon country as unfavorable for mining, as only the very richest mines could pay for working.

*The Omilak mine.*—Four years ago the captain of a whaling ship brought to San Francisco a specimen found on the summit of a hill on Golovin Bay, on the northwest coast of Alaska. It assayed $6,000 a ton in silver, and other specimens found near the same place assayed $275 a ton. A company was organized, and A. F. Williams, R. B. Hurd, C. O. Babb, and others, from Oakland, Cal., embarked in a steam whaler in March, 1881. Two men were put ashore at Omilak, the vessel went on and was wrecked, the survivors returning to San Francisco on the revenue cutters Corwin and Rush.

In June, 1882, R. B. Hurd and party went to the Omilak country on Fish River, and five men remained through the winter. June 22, 1883, the schooner Alaska, with twelve men, two years' provisions, and Captain Gallagher, of the Omilak Mining Company, in command, started north. No reports having been received from them since then, it is believed that a second shipwreck befell them and that all perished. Undoubtedly rich silver and galena ore does exist in that region, as revenue officers and others have found the same rich indications that twice tempted these unfortunate prospectors, and specimens brought down by these officers have assayed at $175 per ton.

# CHAPTER II.

## ARIZONA.

The mountains and hills of Arizona are seamed with gold and silver bearing veins and ledges, carrying nearly all the valuable minerals mined.

Silver occurs in its native state, and also as chloride, bromide, ruby-silver, silver-glance, brittle silver, polybasite, sulphides, carbonates, antimonial siver, sulphurets, and in other combinations.

Gold is found in alluvial deposit, in its native state, in combination with sulphurets and in its matrix of quartz.

Copper occurs in a pure state as a red oxide, carbonate, copper-glance, malachite, and as sulphate.

Lead, iron, cinnabar, platinum, tin, nickel, antimony, and tellurium are also produced. Mica is found in almost every county; asbestos with long white fibers and a delicate texture in Yavapai; alabaster in Graham County, and marble of fine quality in Santa Catalina Range.

In Yavapai, Gila, and Graham Counties are extensive deposits of a superior quality of coal.

There are 15,000 square miles of heavy timber lands within the Territory, the largest continuous branch being the Mogollan forest, containing 12,000 square miles. The timber is pine, oak, and ash.

Large deposits of salt are found in Gila and Yavapai Counties.

Thus it will be seen that the Territory is well supplied by nature with nearly every necessity in the way of fuel, timber, salt, and fluxes for the prosecution of mining and the reduction of ores.

Water is abundant in many localities, and when scarce upon the surface can always be found by sinking wells.

The climate is such that work can be prosecuted all the year. Th winters are very delightful. In the mountains of the western portion of the Territory the higher peaks are covered with snow for the greate part of the season, rendering the air deliciously cool, especially at nigh

The most prominent factors in the development of Arizona are its tw transcontinental railroads—the Southern Pacific and the Atlantic an Pacific.

The former enters the Territory at Yuma and traverses eastward distance of 385 miles into New Mexico. The latter enters the Territor from the east at Albuquerque and passes out at the Needles, on the Co orado River.

This road commands the coal-beds and timber-belt of the Mogolla Mountains. A branch is now being built from Ash Fork to Prescot the capital of the Territory.

The New Mexico and Arizona Railroad from Benson on the Souther Pacific, extending to Guaymas, Mexico, affords an outlet for Southeas ern Arizona.

A narrow-gauge railroad from Tucson to Globe is in course of co struction, which, when completed, will tap the coal fields of Deer Cree the timber lands of the Pinal Range, and some valuable undeveloped mining localities. Other railroad enterprises are under consideration, and doubtless every portion of the Territory will soon be accessible by rail.

The mining interests of the Territory have entered on a career of prosperity never before known; capital is seeking investment, mills and furnaces are being erected, new discoveries made, and prospectors are coming in a steady stream. Its many well-developed mines continue to produce about the average amount of bullion, while many of the lesser ones are giving great encouragement for the future.

Now that the water has been successfully drained from the deep mines of Cochise County, and the ore found continuous and rich under the water-level, the output for the coming year is promising.

Pima County will help swell the stream of silver which will flow out of the Territory from the very rich mines in Quijotoa district in which the principal mining interests are for the present centered. Prospecting has but fairly begun, and the production of bullion has but just commenced.

There was a slight decrease in the production of precious metals during the year, due partly to the closing of one of the leading mines of Cochise County while placing its large pumps.

Mr. Valentine's circular gives the amount carried by express and other conveyances from Arizona during 1883, viz:

| | |
|---|---|
| Gold dust and bullion | $490,686 |
| Silver bullion | 4,147,427 |
| Ore and base bullion, by freight | 3,545,630 |
| Total | 8,183,743 |

The ore and base bullion consisted almost wholly of copper and lead, containing but little silver.

The Tucson Star publishes the following estimate relating to the production of gold and silver combined for the year:

SILVER AND GOLD.

| | |
|---|---|
| Silver King, concentration | $1,041,462 |
| Benson smelter | 723,122 |
| Arizona Central, gold | 265,000 |
| United Verde | 130,000 |
| Pinal Consolidated | 207,771 |
| Tiptop | 37,869 |
| Silver district, silver | 83,925 |
| Silver district, gold | 25,300 |
| Howell smelter | 173,852 |
| Stonewall | 42,000 |
| Golden Rule, estimated | 125,000 |
| Pima County | 281,175 |
| Mohave County, estimated | 150,000 |
| Pinal County, estimated | 175,000 |
| Gila County, estimated | 250,000 |
| Total | 3,711,445 |
| Tombstone: | |
| Contention | 905,695 |
| Grand Central | 868,923 |
| Tombstone Mining and Mill Company | 702,200 |
| Boston Custom | 226,500 |
| Knoxville Stonewall | 125,000 |
| Head Center | 53,582 |
| Total | 2,881,900 |

### RECAPITULATION.

| | |
|---|---|
| Tombstone | $2,881,900 |
| Outside districts | 3,711,445 |
| Estimated output not reported | 1,500,000 |
| Value of copper bullion | 4,228,987 |
| Grand total | 12,322,332 |

After a very careful review of the shipments by express and railroads, and the estimates of Mr. A. M. Lawver, and others, and comparing them with the statements of the railroads, smelters, and refiners, and the deposits from the mills and mines at the mints, I estimated the production of the precious metals in Arizona during 1883 to have been $6,150,000, of which $950,000 was gold, and $5,200,000 silver.

These amounts were, as near as could be ascertained, produced in the several counties, as follows:

| County. | Gold. | Silver. | Total. |
|---|---|---|---|
| Cochise County | $410,000 | $3,050,000 | $3,460,000 |
| Gila County | 15,000 | 120,000 | 135,000 |
| Graham County | 15,000 | 30,000 | 45,000 |
| Maricopa County | 330,000 | 25,000 | 355,000 |
| Mohave County | 20,000 | 150,000 | 170,000 |
| Pima County | 85,000 | 250,000 | 335,000 |
| Pinal County | 20,000 | 700,000 | 720,000 |
| Yavapai County | 25,000 | 800,000 | 825,000 |
| Yuma County | 30,000 | 75,000 | 105,000 |
| Total | 950,000 | 5,200,000 | 6,150,000 |

Three mines in Arizona are reported to have paid dividends during the year, as follows:

| Mine. | Dividends. | Amount. |
|---|---|---|
| Contention Consolidated | 6 | $375,000 |
| Silver King | 7 | 175,000 |
| Total Wreck | 1 | 50,000 |
| Total | 14 | 600,000 |

Five of the Contention dividends were paid in the first five months of the year, and the last in December.

The Silver King paid six dividends in the first six months and the other in December.

The Total Wreck paid its dividend at the East in the early part of the year.

### COCHISE COUNTY.

This county continues to surpass the other counties of the Territory in its production of the precious metals.

The topography of the county is favorable to the construction of good roads, making the principal mining camps easy of access, while the railroads give excellent facilities for shipping.

It contains three custom mills and two smelters which purchase the ore.

Water in its large mines has been a great obstacle to deep mining, but the difficulty has been overcome and the discovery of rich ore below the water-level has at Tombstone infused new life and unusual activity into mining operations, and fully established the fact that the ore bodies are continuous and extensive.

The large expenditures in continuing explorations below the water-level indicate the confidence felt by the owners of mines that the ore-body extends below that point, while the fact that many leading producing mining companies have recently acquired control of properties somewhat remote from the bullion producers demonstrates their faith in the diversified character of the deposits.

*Tombstone* stands pre-eminent among the mining districts of the Territory in the magnitude of its veins; no ore-bodies of equal width and richness have been found in any other portion of Arizona. The ores are generally chlorides and are easily worked.

The mineral belt of Tombstone extends about 8 miles east and west, and may be said to reach south to the Bisbee copper deposits, nearly 25 miles.

In the work of development Tombstone leads all camps in the Territory; although a greater depth has been reached in other localities, there are none where the development has been so general and systematic.

The leading mines are provided with the improved machinery, and the most economical appliances for mining, treating, and handling ores.

The Contention, including the Flora Morrison, and the Sulphuret, is the leading mine of this district and the largest producer in the Territory.

The great event of the camp during the past year has been the erection of pumping machinery, as on the result of its working depended the solution of the problem of the existence of large ore bodies below the water-level.

Before incurring the necessarily heavy expense this undertaking would occasion, every means was taken to ascertain the existence of an ore body below the water-level which would repay the outlay.

In constructing these works use was made of part of the Flora Morrison hoisting engine, which was removed to the site. The foundation for the pumps is probably the heaviest and most solid masonry ever erected in the Territory. The material used is all cut granite. Some of the foundation rods are let in as far as 16 feet in solid masonry.

From Mr. J. F. Thompson, who designed the machinery and superintended its erection, the following description is taken:

"The pumping engine is a compound direct-acting machine; initial cylinder, 26 inches in diameter, 8-foot stroke; compound cylinder, 42 inches in diameter, 10½-foot stroke. The beam of the engine is wrought and cast iron, weighs 70,000 pounds, and measures over all 30 feet 6 inches. The pump-hoist has double engines, connected, and can readily handle 12 tons at one load. The pump-shaft is 6 by 8 feet in the clear, and is timbered with 10 by 10 Oregon pine. The pump and tank stations and the balance bob stations are large and commodious and thoroughly timbered. Pump station No. 1 is 234 feet from the surface and has two 12-inch pumps, 8-foot stroke, with double line of 12 inch pipe reaching to the surface, and will discharge water into a 40,000-gallon tank. Pump station No. 2 is 486 feet down, with pumps and pipe similar to No. 1. Eighty-four feet above these stations are bob stations Nos. 1 and 2. These balance-bobs are each 32 feet above all and are intended to carry 60,000 each. The sinking pump is 18 inches in diameter, 8-foot stroke, and built for a lift of 300 feet, and it is operated with iron rods 3 inches in diameter, working inside a 20-inch pipe. The main pump rods are 13 by 13 inches by 60 feet long, and are strapped with 2,000 pounds of iron at each joint, and work through iron guides placed about 25 feet apart in the shaft. The entire work is put up in the most substantial manner and is supplied with all the latest improvements."

Every success has attended the erection and working of these pumps from the first, all the machinery working perfectly. The pumps drained this mine in six hours after starting, and were not run at more than one-half their speed.

The bottom of the shaft is kept dry and is being rapidly pushed down, having been sunk 100 feet since the pumps were started. The ledge is holding its own, and is believed to be good for many hundred feet more in depth.

While work is pushed ahead vigorously below the water-level, no less activity prevails in the upper levels, and the stopes are still furnishing the usual supply of ore.

Recent developments on the 400-foot level has brought to light one of the largest ore-bodies yet discovered; it is said to be 700 feet in length and about 40 feet wide. As the workings on the lower levels have not yet reached it, its depth is unknown.

On the 600-foot level the prospecting work, which has been so vigorously pursued for some time back, has resulted in the discovery of much good and valuable ore.

The ore which keeps the company's mill at Contention going is principally stoped from the 400-foot level, which supplies more than one-half, while the remainder is obtained from the first and second levels. About 80 tons are shipped daily to the mill, varying in value from $60 to $115, while in some instances it reaches up to $171 per ton.

Samples from the bottom of the winze on the 600-foot level above referred to are studded all over with horn-silver.

The average number of men employed is 110; regular monthly dividends of $62,500 have been paid.

The Grand Central, like its neighbor the Contention, has paid its proprietors well, but they expended over $400,000 before returns began.

A great deal of work has been done here, possibly more than on the Contention, and there are now 20 miles of underground workings to show the activity expended.

The pumps, which, in conjunction with those of the Contention, are to cope with the water, have succeeded in freeing the mine from water, and developments are going on below the water-level.

The pumps of this mine and of the Contention work in conjunction, as it is necessary to keep the same level in the two mines. In the drifts which are being run south of the new hoisting works some new developments have been made on the 300, 400, and 600 feet levels, the last being particularly rich, and giving every evidence to the managers that it will develop into a permanent ore-body below the water-level.

The ledge is well defined, being all the way accompanied by a clay gangue, which is a characteristic feature of a true fissure. Here and there a barren spot occurs, followed in some places by a vast chamber of high-grade ore, from which again the ledge gradually decreases to the usual uniform size. The ventilation is perfect, owing to the fact that the underground workings of the mine are connected with those of the Flora Morrison, the Contention, and others. The north end of the ledge is undoubtedly the most productive. The south extension, though not diminishing in quantity, is decreasing in richness. Most of the prospecting has been done north, south, and west of the ledge, leaving a large unexplored tract lying east of the ore-body.

The discovery of a new parallel ledge west of the old one in the Contention is an indication that there is much ore in this mine awaiting development.

The Tombstone Mill and Mining Company own the following mines: The Tough Nut, Lucky Cuss, Good Enough, Survey, Defense, West Side, Owl's Nest, Tribute, East Side, East Side No. 2, and Owl's Last Hoot, and is under the superintendency of Prof. J. A. Church.

The company is awaiting the issue of the working of the new pumps in the Contention and Grand Central mines, and that they will drain the entire Contention Hill is now certain, but their influence on the water in the Tough Nut, Good Enough, and West Side mines is still unknown. This company is ready to erect pumping machinery as soon as water is struck, if not drained by the pumps on the hill.

Water being encountered in the Tizine at a depth of 450 feet, it is expected that it will be found in the above mines at about the same depth.

At Charleston four new concentrators have been erected, with capacity of 100 tons per day. With this addition the Tombstone Mill and Mining Company possess the most complete reduction works in Arizona, the plant consisting of two wet-crushing stamp-mills, one with 20, the other 50 stamps, and a large water-jacket furnace, erected two years ago, for the purpose of utilizing the great quantity of tailings accumulated from the two mills. At the same time six Frue and Fanning concentrating tables were put up, as the tailings, being of a low grade of lead and carrying a high percentage of silica, had to be concentrated before smelting.

Complete success in operating the furnace was not obtained until about six months ago, since which time the capacity of the furnace has nearly doubled, and the number of concentrators had to be increased. The old style of concentrator working slowly, the new kind mentioned above was adopted. This is a round, cone-shaped table, with a rotary motion, separating the ore by gravitation. The company has now all the concentrators in operation, six of the old and six of the new pattern, which afford an excellent opportunity to compare the merits of the two machines. There is a great quantity of ore in this country of too low a grade to be shipped with profit, but which will pay well if concentrated before shipment. The flux used at the furnace is manganese ore from the Lucky Cuss and Luck Sure mines. As it carries from 40 to 50 ounces of silver to the ton, it is the cheapest flux that could be obtained.

Fifty tons of ore are forwarded to the mill and smelter daily. This is supplied mainly by the West Side, although the Tough Nut and Good Enough are yielding considerable quantities.

The increased output compels the company to stop buying ore, the company's smelting capacity being hardly sufficient to treat the ore produced by the West Side alone. Latest advices from these properties report the quantity of ore now in sight as greater than at any previous time in the past eighteen months, the mill and furnace running constantly and the concentrators working closer than ever before. In the Tough Nut a rich strike has been made. In sinking shaft No. 7, at a depth of 60 feet an ore-body was encountered which promises to rival the famous Combination body, from which over a million dollars of ore was extracted. So far this new ledge is 12 feet across, and averages 120 ounces, being of similar character and grade to that of the Combination. The ore-body is continually widening, with every indication of a lasting mine. On the Good Enough a small force of men is employed, where they are mining some high-grade chloride ore. Most of the workings on this claim are near the surface; the ore is taken out whenever it shows itself, and little prospecting for it has been done.

Owing to the interruption occasioned by litigation between this company and the Way-up Mining Company, for the possession of a large body of ore running into the Way-up ground, development work has been done on the West Side mine, showing it to be valuable and one of the true fissures of the camp.

The depth attained on the Tough Nut and Good Enough is not great, the deepest shaft being only in the vicinity of 300 feet deep.

It is evident that most of the ore produced came from the many small spurs, streaks, and pockets that made the Tough Nut so famous.

It is probable that there must be a large ore-body from which all these minor bodies originated, and to judge from the geological formation of this section, the main ore resource of this company must be in the West Side. This theory is confirmed by the developments of the last few months, as nearly all the ores extracted during that time came from the West Side and the Lucky Cuss. The average depth of the workings on that part of the company's ground is even less than on the other, and the ore-bodies are growing larger as depth is gained and they are holding their own as regards quality. On the West Side the vein is opened up continuously on the second and third levels for 1,200 feet, and is regular and well defined the entire distance. On the fourth level, connection has been made with shaft No. 7, which opens a large tract of ground heretofore inaccessible to stoping. On the fifth level a large body of ore has been struck, which is evidently a continuation of the one above, but much larger in dimensions. It at present measures 8 feet in width and is so far 40 feet long. The ore encountered is a heavy galena. The new strike has proved of great importance to the company, as it has enabled them to smelt tailings, which prior to this, for the lack of lead ore, they were unable to handle. The new hoisting engines in shafts Nos. 1 and 2 are now both at work. An important fact is the increase of gold found in this ore, while the horn silver makes the average assay very high. Large quantities of a fine grade of ore are being extracted from the Lucky Cuss.

On the Defense, another of this company's mines, a number of parties are at work chloriding. It appears to be literally covered with a network of ledges, some of them carrying ore exceedingly rich in silver. This mine has always been an excellent field for chlorides, and is now, as greater depth is attained, increasing in productiveness.

The Daisy.—This fractional claim, which lies between the Survey and Defense mines, is again coming into prominence. Some months ago a rich streak of ore was found and worked out. Not much work had been done on the claim since then until very recently, when operations were resumed with activity. Since then over 20 feet of work has been done, which shows the mine to be very promising.

The Fortunate mine.—While doing assessment work on this fractional claim lying between the Empire and the Tranquillity and Good Enough mines a body of very high-grade ore was struck. This is now being sacked for shipment to the mill. This new strike demonstrates the fact that there are many ore-bodies in this vicinity which as yet have not been discovered.

One of the most promising prospects on Contention Hill is the Aunt Sally, upon which work is steadily progressing. The new shaft, now down 100 feet, has followed a small vein of good ore from the surface with flattering improvement in quantity and grade. The close proximity of this property to the big mines renders it almost certain that the vein will lead to some one of their immense bodies of ore.

Work has been resumed on the Empire mine. This property adjoins the Tranquillity and the Good Enough. The deep shaft No. 1 has been timbered, and another shaft sunken on the northwest end of the claim, now about 200 feet down. A new whim has been put in place. These shafts are connected by a drift 300 feet in length.

The deep workings have been perfectly drained by the pumps of the bonanzas, and the sinking of the main shaft is now going on below the old water level. The new shaft is being sunk without interruption, and with good prospects of encountering the ore-body extending in this direction from the Way-up ground. Prospecting goes on in the old workings in the direction of the ore-body in the Girard, there being little doubt that this extends into the Empire. There is no doubt that the Empire is a valuable property. The situation and the surface indications are good and the ore is easily reduced. The mine has complete hoisting works.

The Silver Thread is a fractional claim located near the Empire mine. While doing this year's assessment work a rich streak of ore was struck in it.

The Girard Gold and Silver Mining Company has done less development and prospecting work on its property than on any other of the group of mines opened about the same time. The main shaft is down some 450 feet, from which there are four levels, at the depth of 150, 250, 279, and 349 feet, respectively. There are only about 2,000 feet of underground workings. The property is very favorably situated, and there is a large body of ore awaiting development. The ledges runs northeasterly and southwesterly, dipping slightly to the east, but in the main it is nearly perpendicular. Three thousand six hundred tons of ore have been extracted from the mine, which averaged about $60 per ton. Most of this was worked at the Girard mill. An assay of the tailings from the ore worked showed them to contain $47 per ton in silver.

The Girard mill is near the Girard mine and has twenty stamps. It cost $85,000. It was in operation but a short time, and during that period milled 15,000 tons of ore, 8,000 of which were third-class ore from the Contention mine, and yielded $35 per ton. The Tranquility supplied it with a further quantity, the grade of which was from $90 to $180 per ton. The mill is supplied with all the latest improvements, and is one of the most complete in Tombstone district. The company received from ore milled $83,355, and from profit on purchase and sale of stock $1,226. The expenses for milling the ore were $64,058, and with other expenses exceeded the receipts, making the indebtedness of the company about $62,749. The shareholders were unwilling to subscribe sufficient to keep things running, and the mine was closed in May, 1882, and recently both mine and mill were attached and sold at sheriff's sale. The property was purchased by a syndicate of five Philadelphia men, the provisions of the purchase allowing the old owners six months in which to redeem the mine. Later a new ore-body was encountered in the mine from the 200-foot level, fully 15 feet in width, and assaying 100 ounces per ton in silver. This important strike has induced the owners to redeem the property. The ore body has been developed and is supposed to run in the direction of the Good Enough.

The Boston and Arizona Smelting and Reduction Company is a Boston corporation. It has a 20-stamp mill and a patent roasting furnace. The works, as well as the Stonewall mine, which are the property of the company, have been worked steadily and have paid handsomely. The mill, which is on the San Pedro River, between the towns of Charleston and Contention, 3 miles from the former place and 10 miles from Tombstone, has, since it started up work, reduced and treated ore as follows:

| | Tons. |
|---|---|
| Customs ore | 12,500 |
| Knoxville (Stonewall) ore | 5,300 |
| Total | 17,800 |

| | |
|---|---|
| Total bullion product therefrom was | $1,250,000 |
| Total amount paid by company for customs ores | 540,000 |
| Total bullion delivered to some of company's clients | 140,000 |
| Expenditures incurred since commencing its improvements | 20,000 |

On the Stonewall (Knoxville) new hoisting works have been erected. The engine is about 30 horse-power, with a boiler 22 by 16 feet, and will do all the work necessary for 1,000 or 1,500 feet. The cable is seven-eighths of an inch thick and about 1,500 feet long. One compartment of the shaft is fitted with a cage, while the other has a bucket. The machinery is complete and in good running order.

A good grade of ore is being taken out, and the present output amounts to 15 tons per day, which is shipped to the company's mill. The mill is running at full capacity, partly on this ore and partly on ore bought from chloriders. As depth is attained the ore gets baser, and contains more rebellious matter; hence the necessity for the erection of smelting works.

The Bob Ingersoll mine has had new hoisting works erected within the year, and the property has been leased by the owners. The ore has become rebellious, and is now shipped to the Benson smelter.

The Old Guard is situated near the Ingersoll. It has a main shaft sunk 230 feet on the ore-body, having followed the ledge from the surface. There are over 300 feet of underground workings. The last development work opened up an ore-body 3 feet wide, averaging $100 per ton on the fourth level. Considerable ore has been extracted from the property, which has been shipped to the Boston mill.

On the Vizina a strike was reported. The latest news from the mines is that a thorough survey of the underground workings is being made, with the intention, it is supposed, of ascertaining whether this strike is on the company's ground or not. The ore is shipped to the Boston mill.

In the Randolph the old 150-foot shaft has been timbered up all anew. Water having been encountered in the lower levels, the work must be limited to the upper.

The Mamie is located near the Randolph. A shaft is down to a depth of 250 feet, but until lately little work has been done. It is worked with success by a party of chloriders, and the ore extracted is sent to the Watervale mill.

In the Oakland, near the Randolph, doing the assessment work, a ledge of very rich ore was struck. The pay streak measured only 18 inches, but has every appearance of widening with increased depth.

The Mozambique lies southeast of the Randolph. It is a good-looking prospect. There is a 70-foot shaft on the property, and they have, in the bottom, a 2-foot ledge of good quartz, with chloride ore.

In the Contact, the shaft, commenced some time ago near the line of the Knoxville, has attained a depth of 167 feet, all of which may be said to be in ore, the character of which is similar to Stonewall rock, being manganese mixed with an abundance of chlorides. At no time has this mine shown up so valuable a quality of ore as at present. The last run realized at the Benson smelter as follows: No. 1 assorted, 185 ounces; No. 2, 60 ounces. The shaft is so deep that windlassing has been stopped for the erection of a horse-whim. This mine is in a direct line with the Sunset, Stonewall, and Randolph.

The Way-up has lately been worked by chloriders under lease, and quite a quantity of high-grade ore extracted, which milled from 97 to 800 ounces of silver to the ton. It is supposed that the owners will hereafter work the mine themselves.

The Gilded Age has been sold to the owners of the Way-up mine. Underground surveys are now being made with the intention of starting work on the mine in a short time.

The Little Wonder is again being worked.

On the Winfield the new lessees are doing well, and the ore hoisted preserves its already known character for richness. Several tons of assorted ore are on the dump. A new shaft has been started on this mine, on a new vein but recently discovered, which promises to equal if not to surpass the old ones in quantity and quality of ore.

On the Blue Jacket work is going on as usual.

The Bonanza is a claim lying between the Winfield and the Blue Jacket. On this ground there are two distinct kinds of ore, one similar to that of the Stonewall, carrying a quantity of manganese; the other is supposed to be the extension and continuance of the Winfield. This property has been leased, and two men are at work there. They are taking out some good paying chloride ore, to say nothing of some manganese ore, with which this part of the district abounds.

The Blue Top adjoins the Bonanza, and the ore found is in narrow streaks, with frequent bunches or pockets of high-grade ore.

On the San Pedro, also, chloriders are at work.

In the North Point, which is an extension of the Contest and Contentment claims, the main shaft is down 100 feet. A drift 30 feet long has been run from the bottom of the shaft, in which the main ledge has been struck, assays from which have gone as high as $206 per ton.

The Dean Richmond, formerly the Bronko, has one shaft down to a depth of about 75 feet and three shafts to a depth of 15 feet, with one open cut about 20 feet in length. At the main shaft about 50 tons of high-grade ore have been taken out, a good part of which is yet on the dump, only a small quantity having been shipped to the Charleston furnaces. Smaller quantities of ore have been taken from the other workings, and a very promising body of ore is exposed.

The Eden Lass is situated about 3 miles southwest of Tombstone. There is a shaft 100 feet deep, showing a small but very rich vein of chloride and carbonate ore.

The Ground Hog, one of the oldest locations in the district, is turning out well. The main shaft is now down 150 feet, at which level the owners intend to commence drifting and cross-cutting the ledge. Within this property the surface croppings are numerous and well defined, whilst in the several shafts sunk ore has been met with, indicating an abundance of mineral. Recent developments will necessitate the erection of more extensive hoisting works and of reduction machinery.

The Blue Monday adjoins the Ingersoll. Work on this mine has been resumed under lease, two new shafts having been sunk, both of them in ore. The main shaft is 300 feet deep, and they are drifting to make connection with their other workings, principally for air. The prospects in this property are very flattering.

The Dwarf is situated about 7½ miles from Tombstone, in the vicinity of the Bradshaw. The developments consist of two 40-foot shafts on the ledge, 100 feet apart, and three other shafts, ranging in depth from

20 to 60 feet. In the bottom of one of the former is a pay streak 16 inches in width, averaging $1,600 per ton, the ore being apparently a blending of carbonates and chlorides. The shaft is all in ledge matter, the width of which has not yet been determined by cross-cutting.

The Mountain Maid is again worked, but is regarded as an almost forlorn hope.

The Helvetia group of mines is about 3 miles west of Tombstone, and embraces nineteen claims and three mill-sites.

On the Clara Dean work has been resumed, and the tunnel is now 65 feet long, while the winze sunk in the breast is now down 12 feet, showing a well-defined ledge, with porphyry and lime walls. Assays from this property go from $186 to $240 per ton, while the mineralized walls go from $9 to $13. A double compartment-shaft will be sunk at the end of the winze.

The Helvetia has a shaft 70 feet deep.

The Mason and the Jackson are opened by two shafts, each 50 feet in depth.

The State of Maine has a shaft down 300 feet. The shaft was accompanied by a vein of ore to a depth of 200 feet, which assayed as high as 250 ounces of silver to the ton. After that depth was reached the ore-body decreased. The owners, however, continued sinking, following a small seam of ore until, after working nearly 100 feet in this manner, their perseverance was crowned with success, and some very high-grade ore extracted. The mine is not yet on a paying basis.

The Silver Belt has been worked again. The main shaft is down 280 feet, and the porphyry raised shows extensive mineralization. The ore met with varies in value from $14 to $40 per ton.

On the Cactus the shaft is now down 80 feet. The ledge has been traced for quite a distance along the claim, and the showing at the bottom of the shaft is one mass of chloride ore. The hanging wall is smooth and well defined for the first 40 feet, and so far no foot-wall has been developed.

The Eucalyptus has a shaft 100 feet in depth, the vein is 80 feet wide, being chloride and black sulphurets. The hanging wall is smooth, carrying 4 inches of clay gouge.

The Gentile Belle.—On this mine a contract for sinking the old shaft has been let. The ledge running through the mine is one of the best defined in the district. Although some very good ore has been encountered, it does not appear in sufficient quantities to pay for shipping. As the adjoining claims are all worked with success by chloriders, there are hopes that this ore-body will increase in size with greater depth.

The Three Brothers.—Chloriders are at work on this mine. Although the ore streak is a very small one, the lease is very profitable, as the ore is rich in silver. Over 5 tons of first-class ore, averaging over 800 ounces in silver, have been sacked for shipment. There is every probability that considerable work will hereafter be done in the neighborhood of this mine, and, from the great blowouts and what may prove to be blankets, there is no doubt that had the Three Brothers been systematically worked, greater attention would have been drawn to this section than has as yet been given to it.

The True Blue lies on the west side of the Three Brothers. The shaft is 295 feet deep, in which several stringers of ore have been met.

The Minititlan, the third easterly extension of the Three Brothers, is likely to make its mark in the district. At a depth of 15 feet the ledge is 3 feet in width, streaks of which are very rich. The ore carries manganese and iron oxide.

Mammoth mine.—The underground workings of this mine are connected with those of the Rattlesnake and Bunker Hill, which belong to the same company. Since last March the bullion production has averaged $10,000 per month. The ore worked at present averages $98 in silver, which is much higher than any previously extracted. The owners contemplate the erection of a mill with larger capacity than the present one, when work will be prosecuted on a larger scale.

On the Rattlesnake mine work proceeds rapidly. On the 160-foot level connection has just been made between the working shaft of this mine and that of the Mammoth, by a drift 400 feet in length, and a stope on the 160-foot level has been started to work the large ore-body there met.

East of the Mammoth shaft are two levels, and for 80 feet these are all in ore. The whims are now raising 12 tons daily, but this will be greatly increased before long. The width of the ore-body referred to varies from 4 to 7 feet, and the ore is free milling.

The Bunker Hill has two shafts, the deepest of which is down 250 feet. Drifting to the amount of 400 feet has been done. The ores of this, as well as of the other two properties of the company, have been manganese in character, which is rather difficult to treat without roasting, but lately the ore has changed into an oxide of iron, from which the silver is much more easily extracted. This group of mines is among the most promising in the district, all of the mines showing large bodies of ore. The Watusah mill is the property of the company.

The Big Comet adjoins the Rattlesnake on the east, and has a well-defined ledge. A 40-foot shaft has been sunk showing up a ledge of ore varying in width from 2½ to 3½ feet, between solid walls. The ore carries iron and manganese, the average value of which is about 60 ounces per ton.

The Emerald is under the same management as the Grand Central. It is at present worked by a force of 20 men. No sinking is being done, the depth being 260 feet. A winze is sunk and the drifts run, with a view to blocking out the ore-body and making it available in the future.

The Grand Dipper.—The present depth of this mine is 160 feet, and sinking is vigorously prosecuted. There are indications that this property will develop into a paying mine.

The Alps lies parallel with and west of the Grand Central. This property is opened by two shafts, one being down 138 feet, and the other 104 feet. A tunnel has been run on the side of the hill, a distance of 126 feet, which has tapped the vein, showing it to be 5 feet wide, containing streaks of rich ore. On the south side of the claim an incline shaft is down 110 feet. There are five other shafts on the property, making in all over 600 feet of openings. On the south side of the Alps float has been picked up that assayed many thousands in value per ton, which evidently has come from a rich chimney.

The Woronoco (San Diego) Company own the San Diego mine and the La Grande, which the company has bonded. These properties are about 2 miles east of Tombstone.

On the San Diego considerable work has been done, the main shaft being down 475 feet, while numerous drifts and cross-cuts on various levels have exposed large bodies of good ore, averaging 75 ounces per ton silver, with 20 per cent. of lead.

The La Grande lies north of the San Diego, and has a shaft down 100 feet with drifts running to the north and south 20 feet each way. The ore assays 20 per cent. lead, with from 20 to 60 ounces per ton in silver. The managers have erected a 30-ton water-jacket smelter at a cost of $25,000. Considerable bullion has been turned out assaying 300 ounces per ton. The consumption of Trinidad coke is 15 per cent., and charcoal 3½ to 5 per cent. At present the San Diego ore is combined with that of the Luck Sure (in proportion of 1 part of the former to 2½ parts of the latter), the No Count, the Gilded Age, the Dwarf, and various small lots from other mines, useful as fluxes. In the making up of different grades of ore into charges lies a great element of success. In connection with the smelter is a refinery in which the bullion is reduced to fineness and the lead reserved. A sampling-room for ore, assay offices, and other conveniences are attached, making this a complete outfit of the kind. The water supply is taken in pipes from the Sycamore Spring Company's tanks on Empire Hill.

The St. Elmo, a property lying near the San Diego, 2 miles east of Tombstone, is being worked. The shaft is now down 27 feet, and streaks of mineral have been cut through. Specimens rich in horn-silver have been met with, and the owners are much encouraged with the present outlook. The formation is solid and the surface croppings show the ledge running through the claim and traceable its entire length.

The Prompter is one of the most promising mines in the camp. The vein is well defined and continuous, carrying chloride, and in places is over 40 feet wide. The formation is porphyry and quartzite. Shaft No. 1 is down 210 feet; the ledge has been cross-cut at the bottom, and shows a width of 43 feet. There are three pay streaks, 5, 7, and 9 feet wide, respectively. The average of the ore milled from every one of them has been $35 per ton, silver. Shaft No. 2 is 450 feet east of No. 1, and is down 50 feet. A cross-cut shows the ledge at this point to be 35 feet wide, with ore of the same character as that in No. 1. Shaft No. 3 is 300 feet east of No. 2, and is down 50 feet all the way in ore worth $40 per ton. Shaft No. 4 is 200 feet east of No. 3 and is 90 feet in depth. This shaft is on a spur from the main ledge. At a depth of 70 feet a cross-cut connects it with shaft No. 5. In running this cut a body of carbonate ore was encountered, 8 feet wide, assaying $100 per ton. A winze is sunk on this ore-body all in high-grade ore. The developments have hitherto been chiefly in the upper level, but since the strike above noted hoisting works have been erected and drifting begun in the 200-foot level in shaft No. 5 to strike the next ore-body encountered on the level above, on which the winze has been sunk. Another strike is reported to have been made in the Prompton, viz, a body of soft carbonate and black sulphurets. Assays range from $400 to $2,000.

The Sidney lies parallel with the south extension of the Grand Central, and is undoubtedly a very promising property. It is being worked through three shafts. The north drift is down 113 feet. At this depth a cross-cut and drift have been started. From the south shaft a cross-cut was run, which, 120 feet west of the shaft, encountered an 8-foot body of chloride ore. It is thought that the Grand Central ledge runs in a southwesterly direction through this property, and that about the center of the claim it will run into the Alps mine.

The Luck Sure has been steadily developed with most gratifying results. A whim was erected by which the ores are hoisted to the surface and thence conveyed to a convenient ore-bin by a double-track tramway, so arranged that the full car going down pulls up the empty one. At a depth of 265 feet a large body of ore was struck. The winding and twisting of this ore-body which was vigorously followed, and the considerable depth attained rendered the whim inoperative, and the shaft is to be straightened. In the bottom the ore is as rich as ever, and when the shaft is in proper shape it is intended to put up a steam hoist and systematically develop the mine. The property has paid its own way and netted $5,000 in six months.

On the Sea Surge work is steadily continued. At the bottom of the well-ventilated shaft the ledge is 2 feet wide. After having stripped the ledge for some distance stoping was begun, and the first shipment of ore to the mill will shortly be made.

The C. O. D. adjoins the Luck Sure, and is in the neighborhood of the Lucky Cuss. The main shaft is now down 172 feet, and sinking proceeds daily. At the 70-foot level in this shaft a fine body of ore was met with which measured 8 feet wide. At the bottom a cross-cut is now being run. On the surface the ore was mingled with hard flinty quartz; this has given out, and the ledge matter is soft and easily worked.

The Lima Consolidated Company owns three mines, the Green Cloud, the Lima, and a fragment called the Old Necomis. On the first two claims considerable work has been done. The shaft sunk on the ledge is down 265 feet. This ledge has the same direction as that of the Grand Central and Contention mines, nearly north and south. Four levels have been started at 85, 135, 190, and 250 feet, respectively, from all of which drifts have been run in on the ledge; that on the 135 foot level being run 60 feet north, and the same distance south. The ledge, from the surface down, shows good and strong, and, as depth is attained, widens out, until at the 250-foot level it is 5 feet in width. From the bottom of the shaft ore was hoisted, and from the north drift, 250 foot level. The ore, which is mixed with a good percentage of manganese, contains chloride and horn-silver, and a fair average of the ledge may be put at $35, while with a little sorting an average of $80 is attained.

The Pedro Consolidated Mining Company, situated on Military Hill, south of the Lima Consolidated, after driving a tunnel 550 feet, has been temporarily closed.

The Republican, in a review of Tombstone district, recapitulates the amounts of ore and silver produced by the various mines as follows; most of the figures are stated to have been derived from the books of the different companies:

RECAPITULATION.

| Production. | Tons. | Value. |
|---|---|---|
| CONTENTION. | | |
| First five months in 1883 | 13,652 | $553,085 95 |
| July and August | 2,455 | 84,869 64 |
| Last five months | 10,000 | 350,000 00 |
| Total | 26,107 | 987,955 59 |
| GRAND CENTRAL. | | |
| Ore produced | 29,250 | 854,522 00 |
| TOMBSTONE MILL AND MINING COMPANY. | | |
| Ore produced | 16,322 | |
| Silver bullion | ........ | 611,084 00 |
| Gold in bullion | ........ | 60,313 00 |
| Lead in bullion | ........ | 30,936 00 |
| Total gross production | ........ | 702,333 00 |
| LUCK SURE. | | |
| Ore produced | 680 | 35,977 29 |

*Recapitulation*—Continued.

| Production. | Tons. | Value. |
|---|---|---|
| RATTLESNAKE COMPANY. | | |
| Ore produced | 1,980 | $98,000 00 |
| BOSTON AND ARIZONA SMELTING AND REFINING COMPANY. | | |
| Knoxville ore produced | 2,250 | |
| Custom ore | 1,330 | |
| Total | 3,580 | 226,500 00 |
| WORONOCO GOLD AND SILVER MINING COMPANY. | | |
| San Diego ore output | 95 | 4,250 00 |
| Custom ores | 320 | 7,625 00 |
| Total | 415 | 11,875 00 |
| WAY-UP. | | |
| Ore produced | 550 | 6,250 00 |
| INGERSOLL. | | |
| Ore produced (approximated) | 950 | 28,500 00 |
| VARIOUS OTHER MINES. | | |
| Ore produced | 1,200 | 54,000 00 |
| Total ore produced, 1883 | 81,034 | 3,005,912 88 |

COPPER QUEEN.

| | Tons ore. |
|---|---|
| January 1 to November 30, 1883 | 31,323 |
| Estimate for December, 1883 | 2,800 |
| Total | 34,123 |

| | Tons bullion. |
|---|---|
| January 1 to November 30, 1883 | 3,606 |
| Estimate for December, 1883 | 320 |
| Total | 3,926 |

| | |
|---|---|
| Total value | $1,136,366 27 |
| Dividends during 1883 | $500,000 00 |

*Cochise district* is situated in the northern spurs of the Dragoon Mountains, adjacent to the line of the Southern Pacific Railroad. It has a good supply of wood and water, and a delightful climate. The Peabody is the principal mine in the district. This claim is in the low rolling hills, 7 miles north of Summit station, at Johnston, on the Southern Pacific Railroad. The ore is copper-bearing, but it also carries some silver. A smelter has been erected, and has been in operation over a year. Regular bullion shipments are made, and the mine is thoroughly opened by shafts, drifts, levels, &c. A strike of a new body of ore in this mine is reported. The 30-ton copper furnace is running steadily, and there is some prospect that the company will erect another large one, of 50 tons capacity.

The Golden Rule mine has lately become one of the solid bullion producers of Cochise County. It is in the Dragoon Mountains, 4 miles from Dragoon station, and a mile south of the pass, just where the last swell of foothills sinks into Sulphur Spring Valley.

The Golden Rule is one of eight claims, of which it is the most developed. The other seven are the Blue Top, the Bell, the Wellington, the Apache Chief, the Dexter, the Golden Sight, and the Emma.

The Tombstone Epitaph contains an excellent description of this property, of which it says:

"The mineral vein is a gold and silver bearing 'lead carbonate,' lying in a contact of porphyry and quartzite. The lead crops above the surface over 1,000 linear feet inside of the limits or lines of the claim, and averages 2 feet in width.

"Shaft No. 1 (the main working shaft) has reached a depth of 135 feet. At 54 feet from the surface, levels are driven both ways on the vein. The east drift is 50 feet in length, while the west has been extended to a distance of 490 feet. The second level drives west at a distance of 135 feet from the surface, and is in 20 feet. Shaft No. 2 is 250 feet (horizontal measurement) west of shaft No. 1, connecting at a depth 137 feet with the first level extending west from the main shaft. A winze is being sunk to connect level No. 1 with No. 2, for the purpose of securing better ventilation, and also to block out ground for stoping.

"The vein stuff is shot down from the stopes into mills, or shutes, emptying into the tram-cars which run to the shaft and are hoisted to the surface, where the contents are dumped into ore-bins. These ore-bins have inclined floors dipping toward front slides, which when raised allow the ore to drop into the wagons for transportation to the mill, 6 miles distant. These wagons are built especially for their work, and dump their load through the bottom. When the mill is reached the wagons drive over the top of receiving bins (which are underground), the trap in bottom of the wagon is dropped, and the load enters the bin.

"The mill is a 20-stamp mill, containing crushers, four Frue vanners and other machinery used in the reduction of the ore. As the mill is built on level ground it was necessary to construct an artificial incline 600 feet in length from the receiving underground bins to the second floor. Over this incline a tram cable car runs, conveying the ore from the bins to the receiver. From here the fine ore passes through the grizzles, the coarse through the crusher, thence into the automatic feeder, which conveys it to the stamp battery. The pulp passes through the battery mesh, thence over copper plate to the concentrators. These concentrators are Frue vanners; each one saves a ton of concentrates per diem. The excellence and thoroughness of the concentrating work performed by the vanners is obvious from the fact that the tailings do not exceed 50 cents per ton in value. The concentrates return a net profit of from $80 to $100 per ton. Amalgamation of the pulp is principally made in the battery, and on the copper plates which collect from $20 to $25 per ton in free gold. The concentrates are shipped to Benson for smelting and return of bullion. This mill is one of the finest ever brought to the Territory.

"The various workings, including the stopes, show the average width of the vein to be over 30 inches. The walls are clearly defined, and, as usual with dead veins, the vein stuff has shrunk from the walls, leaving space for selvage to accumulate. The ore, as it is brought to the surface, has an average value of over $30 per ton. Every working shows ore nearly uniform in quantity and quality. Thousands of tons are blocked out for stoping, and every indication shows that the quantity practically in sight can be doubled as fast as power and drill can do the work.

"The finest showing in the mine to-day is in itself an almost certain proof of the increasing value of the property. We refer to the breast of ore at the head of the 490-foot drift (first level). This heading last week opened to nearly 4 feet of solid ore, and at the date of this writing has opened to 7 feet between walls. This body of ore, which equals in grade any previously opened up, is 180 feet below the surface, and the drift is constantly attaining depth as it is being driven further into the mountain. The daily output of the mine is producing a monthly net profit of from $20,000 to $23,000."

*Turquoise district.*—Very little active work has been going on in this camp.

On the Defiance, Hidden Treasure, and Last Chance some work has been done. At the north end of the camp are the Elgin, Fitzgerald, Plata Verde, and Superior claims, which show strong leads. In the Huachuca Mountains a number of prospectors report having made good discoveries, and display specimens containing native copper in large quartzites.

In the Nellie James mine there are two ledges running almost parallel. Ledge No. 1 carries free-milling chloride ore, while ledge No. 2 contains very heavy lead ores. Most of the work has been done on ledge No. 2, and the results are surprising; the ledge at present, at a depth of about 40 feet, shows a 4-foot body of sulphide and sulphurets of lead. The country rock is lime, which is the case with all large lead mines. Until recently the ore produced has been shipped to Charleston, but transportation being expensive, a small smelting furnace has been erected at the mine, and only the crude bullion will be shipped. The Nellie James is one of the most promising properties in the district.

The Lena mine, in Montezuma Cañon, is being actively worked, and has an open cut of fifty feet, showing a well defined ledge of galena. With a force of eight men they are now shipping 40 tons of paying ore per day to the Charleston smelter.

At Ah Cañon the stamp mill has been running steadily since it was first started; five more stamps are to be added as soon as possible, and with the aid of these it is expected that the mill will be able to treat all the ore at present produced.

*Dos Cabezas district.*—Copper mining is carried on extensively in this camp. Among the best properties are the Star King, the Isabella, and the Green Monster, all on one ledge. The ledge runs north and south, and is almost 100 feet wide for the entire length of the three claims; high-grade copper ore is found in many places.

On the Star King and Isabella, ore is found that assays as high as $80 in gold and $30 in silver, and nearly all the ore assays from 4 to 15 per cent. copper.

The Juniper gold mine continues to improve in appearance as the work of development progresses. It is being steadily worked.

On the First Chance, the Cincinnati and Pittsburgh Mill and Mining Company have developed a large body of high-grade ore quite recently. The strike was made at a depth of 120 feet from the surface. The company has a large force of men engaged in extracting the ore, which is being hauled to their 10-stamp mill, located in Dos Cabezas proper, a distance of 2 miles from the mine.

In the Maple Grove mine a rich strike has been made. Assays have shown an average of $200 per ton, in gold.

The Silver Cave mine contains three veins, varying from 3 to 7 feet wide, which have yielded $35 per ton, in gold.

*Warren district.*—Bisbee.—This locality, about 30 miles south of Tombstone, is principally copper producing.

The large ore-bodies are found in lime and quartzite, but there is also considerable porphyry.

One of the most important mines is the Copper Queen. The Hend ricks is the only one which carries silver. Nickel is also found.

*Teviston district.*—Mr. M. E. Kinchaler, furnishes the following information regarding the mines in this locality.

The oldest mines here are the Old Man and the Old Woman of the Cincinnati Company. The tunnel, which is in about 40 feet, is 5 feet by 7 feet. The ledge is 7 feet wide, pay ore 5 feet, assaying $30 in gold and $40 in silver per ton.

The Mary has one shaft down 125 feet; the ledge is 6 feet wide; pay ore 4 feet. A tunnel is in 185 feet, no waste, all ore.

The Dutch Girl has a 5 by 7 foot shaft down 60 feet, all in ore.

The General Meade has a tunnel 50 feet long in good ore, and a shaft down 14 feet in ore.

The Berkshire and Bumble Bee have each a 20-foot tunnel, and the Gotham a 10-foot shaft, all in good ore. The Fountain mine is down 45 feet; the ledge is 2½ feet with rich gold rock averaging $300 per ton.

The Chicago mine has a shaft down 100 feet, with drift 20 feet east and west in good ore.

The White Chief has had two assessments; the ore is silver.

The Eighty-One, the Red Jacket, the Giant, the Bear, the Bella, the Josie, and the Mineral Park have all had more or less work done on them.

There are many more good claims here, but all of the same general character. A Dodge crusher and pulverizer were in use, but proved a failure, as the ores are concentrating. Only about 20 tons have been milled, yielding $35 in gold and $55 in silver. All the mines here have mproved in prospect since last year's work.

The Cochise and Saint Louis Mining Company will start up the coming spring. There are over 10,000 tons of pay ore on the dumps in this camp, but there are no reduction works to make them available. All of the capital is from the east and all of the managers are farmers who do not know wall rock from ore, or, in fact, anything about mining.

The district is 9 miles from Bowie station, Southern Pacific Railroad. The good roads make shipping facilities excellent, and there is plenty of wood and water at or near the mines.

There is one close company here, and no reliable information can be obtained as to what is being done. It started with little capital, but has done well, having purchased a 10-stamp mill and four concentrators, which were paid for from its mines.

The following information is furnished by Mr. J. C. Wilson, one of the original locators of the New Discovery, in the Galena Mountains, 12 miles from King's Springs.

The situation for a camp is delightful, there being an abundance of both wood and water, and, better than all, a ledge of ore 8 miles long; and it is claimed by practical men who have been there that the mineral belt is 1½ miles wide. The main contact lode runs due north and south.

Wilcox & Co. own seven claims on this lode, on which some fifteen men are employed. It is the intention of the company, which is already shipping ore, to erect a 40-stamp mill and employ 150 men. The ore is free milling.

On the Wilson & Co.'s claims little except prospecting has been done, but work will be commenced at once on the Warrior, one of the most promising claims in the district. In the Columbus, owned by the same company, rich ore has been discovered. This strike was made in the deepest part of the cañon, 400 feet below the Wilcox properties.

There are in this camp at present about fifty men in all, ten or twelve of them employed as packers, while the others, exclusive of the fifteen employed on the claims, are prospectors working their own locations.

At *Benson* is located the custom smelter of Salisbury & Co., which is proving a success to the company, and is of great benefit to the owners of small mines containing rebellious ore. This company has purchased the Schuylkill mine at Chloride, and are now working eleven men and extracting six tons of heavy lead ore daily. The galena shows for over 2,000 feet along this ledge, on the Schuylkill and the adjoining claim, and is from 6 inches to 3 feet in width, carrying from 17 to 24 ounces silver per ton. The ore from the Schuylkill is shipped to the Benson smelter. They have also leased 500 feet of the westerly end of the Atlanta mine at Bisbee, where a lead carbonate ledge is known to exist, as it has been proved to run into this ground from the Hendricks. Salisbury & Co. have interests in or own a number of mining properties producing silver, lead, copper, and iron.

I have placed the production of this county for 1883 at, gold, $410,000; silver, $3,050,000; a total of $3,460,000.

### GILA COUNTY.

This county is the most thoroughly mineralized division of the Territory. Its ledges are famous for their richness, producing gold, silver, copper, and iron. Salt, gypsum, and asbestos are also found. The Mineral Belt Railway, connecting Globe with the Atlantic and Pacific Railroad, 150 miles distant, when completed, will overcome the disadvantage of isolation under which this region has labored, and will open the vast mineral resources existing along its entire route. It will also open up an immense region of very superior and heavy timber land, equal in quality to that of Oregon.

Copper has thus far been the principal metal produced. There is an ore-body of copper about Globe, 8 miles in length by 1 mile in width, in which occur veins and deposits, mostly of carbonates, oxides, and copper glance, with ample fluxing material in the vicinity.

*Globe district.*—The McMorris mine has been shut down, but will probably be worked very soon. The McMorris mill (the Baldwin) is at present running on tailings.

The Silver Nugget, at Richmond Basin, is being thoroughly developed.

The Silver Fame Mining Company has shipped 20 tons of ore to McMillen, which has returned an average of 419 ounces of silver per ton, notwithstanding the fact that 6 tons out of the 20 were second-class ore.

The old Isabella group of mines, which are situated about three-quarters of a mile east from the Silver Fame, are developing into wonderfully rich and valuable properties. The owners abandoned these mines about three years ago as worthless, under the supposition that they were dug out, when in fact they were undeveloped. The owners are running their 5-stamp mill on ore from these mines. The Isabella mine will start up soon on custom work.

The Buffalo Mining Company have been at work developing their mines, and the superintendent reports the mines in good condition. This company has first-class reduction works, situated near its properties, which will probably soon commence operations.

The Old Dominion Copper Company has bought all the property and the plant of the Long Island Company, consisting of the Cuperite, Gray, Hoosier, and Nevada mines and the 30-ton smelter. The furnace has been removed to the site occupied by the other Old Dominion furnaces. A new 30-ton smelter has been put up, and the company now has three furnaces in operation. In one of these petroleum oil is used as fuel, and the company have shipped 50 tons of ore to Baltimore to test this fuel. It is reputed that the output of copper for the coming year will be the largest made by the company.

The Hoosier mine is looking as well as usual, and is turning out the regular amount of ore. It will soon be shipping bullion from the reduction works near by.

The Topea Group, embracing the Topea, Mark, and Foote, is on a well-defined ledge. The three claims are on the same lode or vein, which shows good ore everywhere on the croppings. The vein is fully 6 feet in width, with splendid walls, and shows every indication of permanency. It crops out for over 3,000 feet, and is in a syenite and granite formation. The deepest workings on the ledge are on the Topea mine, the middle claim. On this claim a shaft has been sunk to the depth of 60 feet, and shows at that depth an average of $82 per ton in silver for the whole length and width of the shaft. The ore is of the same character as that of the South Pioneer. The Foote, east of the Topea, has two shafts 30 feet deep, both of which show the same grade and quantity of ore as does the Topea.

The Olympic.—This mine has one shaft down 30 feet, which shows 18 inches of high-grade ore, and another down 50 feet which shows from 12 to 18 inches of ore, running from $50 to $2,000 per ton in silver. The ore is free milling and carries chloride and sulphide. The Topia group and the Olympic are situated in the Pinal Mountains.

On the Stonewall but little ore is being extracted, as the entire force is at work opening the winzes to restore the circulation of air in the lower levels. This has been a tedious and expensive job. At the Stonewall mill the stamps are constantly crushing. There have been over $10,000 worth of bullion shipped from the present run.

The Chambord mine.—On this mine is a shaft 135 feet deep with 75 tons of a good grade of ore on the dump. This is one of the many properties whose value will be greatly enhanced by the building of a railway to this district. It is only 2½ miles from Globe, over an easy roadway, and in a geological formation that offers every guarantee of permanency. It is looked upon as one of the best copper prospects about Globe.

On the Red Rover a rich discovery has been made, the ore from which is almost malleable silver. Both native and horn silver are found in the ledge. The strike has been pronounced unexcelled by any other prospect yet discovered in Globe district.

The Irene is a strong vein and is opened by a shaft 300 feet deep, and which shows 4 feet of ledge matter that has yielded $100 per ton.

The Gipsy mine.—On this mine the outlook is very promising. A shaft down 105 feet seems to have struck the northeast point of a large chimney of high-grade ore. Drift No. 1, at the 30-foot level, running in a southwest direction, is now in 15 feet; drift No. 2, at the 105-foot level, shows even a stronger vein. The entire workings show a strong vein of rich-milling ore. At present this is a very promising prospect.

*Mineral Creek district.*—The Howard mine.—The shaft in this mine is down 310 feet, with a vein averaging 4 feet wide of good milling ore. This vein, from a depth of 220 feet down, shows a rich pay streak from 3 to 15 inches in width carrying horn-silver, black sulphurets, and malleable silver in great quantities, which averages, from 10 assays, $9,773 per ton.

The Howard mill is shut down for the purpose of changing it to a dry crusher and putting up roasters, the ore being too base for raw amalgamation. As soon as the necessary change can be made the mill will be started up again.

The South Pioneer is 600 feet from the Howard. It has a shaft 370 feet deep, and shows largely in native silver. The ledge is 4 feet and 4 inches wide, and carries an exceedingly rich pay streak from 13 to 24 inches wide. The average assays across the ledge give $259.51 in silver. Preparations are making for sinking another 100-foot and opening up the 400-foot level. A pump of sufficient capacity to keep the shaft clear of water has been put in place on the mine, so that there will be no more delay on account of water in the work of sinking. All the stopes and levels in the mine look well, and there is an abundance of ore in sight.

I have estimated the production of this county for 1883 at gold, $15,000; silver, $120,000; total, $135,000.

### GRAHAM COUNTY.

This county has been most wonderfully developed within the present year, principally in its immense ledges of high-grade copper, some of which bear precious metals. Wood and water are abundant, the ores are of a high grade, and the climate is perfect throughout the year.

A narrow-gauge railroad has been built connecting Clifton with the Southern Pacific Railroad at Lordsburg, 65 miles distant, which will be of great benefit to the county in the cheapening of supplies and transportation, thus enabling the working of the low-grade ores which abound in every direction.

*Gold Gulch.*—There are in close proximity to Clifton a number of very promising mineral sections, which, while not as yet regular shippers of ore to reduction works, need only more development work and a judicious expenditure of money to make them such. Among this may be mentioned this section, known as Gold Gulch, which, as its name indicates, is a mineral belt that carries precious as well as base mineral in its veins and ledges.

Gold Gulch proper is the watershed leading down to the Eagle River, westward from the mountains bordering on the west side of Chase's Creek, and in which are situated the mines of the Arizona Copper Company and those of the Detroit Copper Company. It is easy of access, a good wagon-road having been constructed from the Detroit Copper Company's mine over into and through the gulch. The general formation is lime, syenite, and gneiss, interspersed in places with porphyry. The ore found in this section is of many different kinds, copper carbonate predominating, while bromides and red oxides are also found. On Eagle River, 4 miles distant, there is available ground for reduction works and abundance of water-power.

The Arizona Copper Company's properties, which comprise the Longfellow, Queen, Metcalf, and Coronado, are being worked under a general mining system, and are connected with the furnaces in Clifton by a narrow-gauge road, which is 9 miles long, and each mine is connected with the railroad by inclines, one of which, that of the Coronado, is 3,200 feet in length. Extensive hoisting works and other machinery will be erected as depth is attained. The excavation and grading o the flume for the new plant are rapidly approaching completion. The r are to be 3,800 feet of ditch and 4,500 feet of flume, the dimensions o

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which are 7¼x4 feet in the clear. The water is directed into the ditch by a pile shoulder-dam across the San Francisco River, 150 feet long and 4 feet high. At the head of the ditch there are abutments 100 feet long between the ditch and the river bed, to protect the former from high water. About 1,000 feet from the dam there is a sand gate and ditch leading back to the river again, to allow the sand and *débris* which may be deposited to flow off, thus keeping the flume entirely clean. There are four bridges on the flume, one of which is 100 feet long. At all other points it is built on solid ground, which is principally hard rock. By this flume and ditch a 24-foot head of water is obtained at the smelter, which is nearly sufficient to run two of Leffel's improved turbine wheels of 40 and 48 inches diameter, respectively.

The Longfellow is the principal mine of this region. The ore is not only high in grade, averaging fully 20 per cent., but it is self-fluxing and easily manipulated. So readily does it yield to the action of the furnace that 1 ton of coke will smelt about 7½ tons of ore. The mine has a large body of ore exposed, and a tunnel is being run, which will, it is thought, strike the ore-body at a depth of 720 feet. For the last three years the Longfellow has produced annually over 4,000,000 pounds of copper bullion.

For the rest of the group, the report of Messrs. Williamson and Rankin, Scotch engineers, is quoted:

"In our first report we touched lightly upon the ore found in these mines, as the works had not progressed to any advanced stage. Since then a large amount of work has been executed, and the Queen mines have now developed into a valuable property. The vein to which we referred as being irregular has proved to be a true fissure vein which has been drifted into by upper and lower levels, disclosing a large quantity of high-grade ore. The width of the vein runs from 2 to 3 feet, and an output of over 30 tons per day may now be regularly had for many months at small cost, even supposing nothing more should be disclosed. The ore to all appearances continues to improve as the mine deepens, the strike of the vein being indeed traceable on the surface to depths below that to which it has already been opened out. The mines have now been connected with the private railroad by a self-acting incline, 1,500 feet in length, of excellent construction, as all the inclines are, so that the ores may be readily sent to the works.

"Coronado.—A large amount of work has been executed at these mines. The day tunnel has been drifted nearly through the crest of the hill, having advanced a total length of about 1,400 feet, measured from both ends, which are now within from 40 to 50 yards of being connected. A greater length of it is in barren ground that we anticipated, but that is partly accounted for by the fact that latterly the object has been to push it through in the ground where the material was softest. Some exploring side mines and shafts have been also driven, but these have not been generally so successful in finding ore as we would have liked. On the other hand, additional shafts and short mines further down the hill, on the Boulder and Horseshoe claims, have disclosed rich and valuable bodies of ore, so that altogether we see no reason to depart from the opinion we formerly expressed regarding the value of this group. A considerable quantity of ore has been accumulated at various dumps, and there will be no difficulty in sending away and maintaining a daily output of 30 or 40 tons.

"Metcalf.—The work done at these mines has been of considerable extent. A self-acting incline, 1,200 feet in length, has been completed to these mines, and a proportion of the ore now used is regularly sent to the smelters. There is a quantity of ore, estimated at 800 tons, on the dump, and we see no difficulty in obtaining a regular supply of over 40 tons per day, at a moderate cost per ton, from these mines, but we have not the requisite data for offering an opinion as to the permanence of the output."

The Detroit Copper Company's properties, adjacent to the Longfellow and Queen mines, are also very rich, and comprise a great number of claims. These mines are working a large force and the ore is shipped direct to the company's furnaces, a short distance below Clifton. A survey has recently been made from the mines to the furnaces to estimate the cost and feasibility of constructing a narrow-gauge railroad for transporting the ores, and it is reputed that work on the new enterprise will soon be commenced.

Yankee Claims.—These claims are eleven in number, the principal of which are the Great American, Low Divide, Black Copper, Copper Glance, and Terrible.

The Great American is the best developed. Four shafts have been sunk in this, ore being 10 feet deep. An open cut through an iron cap rock uncovered a good body of copper-glance ore. Assays from this claim give $68 in silver and 21 per cent. copper.

The Low Divide and Black Copper are similar to it in formation and class of ore.

The Terrible has three shafts sunk upon it, each down about 15 feet, representing three years' assessment work, all showing ore in the places where sunk.

The other claims of the group look well. The general formation is lime and porphyry.

The Great Expectation is one of the most promising mines in this section. It has a shaft 21 feet deep, 11 feet of which is in solid ore of high grade. This claim, which is in lime and porphyry formation, is in close proximity to the Longfellow and Detroit Companies' mines. The ore is a red oxide.

On the Olie mine, belonging to the Great Western Mining Company, work is progressing favorably in the tunnel now in about 118 feet. Cutting through several formations a body of ore was encountered at 30 feet, assaying well in gold and silver, and carrying some copper, and 10 feet further a streak of copper was met, similar in character to that of the ore taken from the shaft. The tunnel is now being driven to again cut this ore streak of copper at its present depth. This claim, which is an extension of the Copper King, is rich in copper. From 100 pounds of ore taken from the shaft, mill-runs of 50 pounds of refined copper bullion were obtained, besides a percentage of gold and silver.

Clifton Hydraulic Company.—About 4 miles above Clifton, on the San Francisco, large gravel deposits exist. These gravel-beds are all gold-bearing, and careful tests have proved that they will pay. The Clifton Hydraulic Company has brought water in iron pipes a distance of 4 miles to these beds. They have sunk shafts and driven tunnels, and thoroughly explored the ground. The gravel is on both sides of the river, and will average in depth from 10 to 30 feet, and has an estimated area of 3,000 acres. Gold is found all through this gravel, from the surface to the bed-rock. The company has expended a large sum in getting ready for work, and have the latest improved hydraulic machinery, a splendid fall from the San Francisco, and everything in good shape for a long and successful run. High up on the mountain side, above the gravel deposits, is a group of gold-bearing quartz ledges. These veins are from 2 to 6 feet in width, in a formation of granite, and can be traced for several miles across the country. A few openings have been made, and some ore worked that produced over $20 per ton. With the fine water-power to propel machinery so near at hand, very low-grade ores can be worked, and a prosperous gold camp will likely spring up here.

*Greenlee Gold Mountain district.*—A rich silver discovery has been made in this new district 8 miles from Clifton. There are about 150 claims now taken up, and the work of developing some of the richest has begun. Several shafts are being sunk, and as depth is gained the ore increases in quantity and improves in quality, there being gold enough to pay expenses of extraction. The highest assays yet made returned 1,281 ounces in silver and $27 in gold. One of these assays, from pieces of rock knocked off from the surface of the ledge on thirteen different claims, returned 168 ounces in silver and $24 in gold. If these mines prove to be as good as experienced miners anticipate, the new camp will be one of the richest in the Territory. The mines are about 2 miles from the San Francisco River, where there is ample water for milling and smelting purposes.

*Ash Peak district.*—Situated about 30 miles south of Clifton; is a promising mining locality. Recent assays made from croppings taken from one of the claims went over $100 in silver, and also yielded a good per cent. in copper.

The Parker Group, situated between the San Francisco River and Chase Creek, 1 mile east of the Metcalf Mountain, comprises 37 claims. These are principally copper prospects, carrying also a good per cent. of gold and silver. The ledges are large and well defined and from 10 to 14 feet wide. About $1,500 have been spent in development.

On the Shot Copper claim a tunnel has been driven 60 feet, which shows both copper and silver, having cut a good galena ledge. There are 6 feet of loose dirt on the surface of this claim, carrying much shot copper, which can be panned out, and would pay well by using concentrators.

On the Bonanza claim a 30-foot shaft has been sunk, which shows 18 inches of copper glance ore and assays well.

The Pride of the West has a 7-foot shaft, which shows 3 feet of black sulphurets and peacock ore, assaying 60 per cent. copper, and also carrying some native copper. The ledge is fully 9 feet wide.

On the Hannibal a 40-foot tunnel has been driven, and it is reported the lead will be struck 10 feet farther. The outcroppings show up well, and there is every indication of a wide copper ledge.

The Big Horn claim has a 10-foot shaft, which shows some native copper and green carbonates all the way down which looks well.

The Bulkhead has an 18-foot tunnel, which shows 18 inches of black oxide of copper, resembling the Longfellow ore, with about 35 per cent. copper.

Very recently a rich discovery was made in the Galura Mountains which has excited great interest. The mines are between two ranges of mountains, 75 miles northeast of Tucson, 16 miles north of King's Warm Springs, 35 miles below Benson, and 9 miles east of the San Pedro River. Four claims have been located, the Union, Keystone, New Idria, and Alta, and the ledge found to be 8 to 12 feet wide and more than 6,000 feet long. It runs north and south and dips to the west. Assays made of croppings showed up remarkably rich in silver, with some gold. Eleven assays have been made from the croppings, averaging $205.

In Rocky Gulch are the Cimarron, Wayne, Barbara, Old Stiff, Wedge, and Greenhorn claims, which are reported to be very rich properties. I have estimated the production of this county for 1883 to have been: Gold, $15,000; silver, $30,000; total, $45,000.

## MARICOPA COUNTY.

This county has many ledges known to be rich in gold and silver, few of which are as yet developed, although it has some properties producing gold, silver, and copper. The country has not been much prospected, and agriculture and grazing continue to be the principal industries.

*Myers district.*—The Gunsight mine.—The mill building is 44 by 84 feet, and is in every respect a substantial structure. The machinery is all of the best quality, and combines the latest improvements. The water supply is ample for all requirements, and seems inexhaustible. All the recent developments in the mine are such as to apparently justify the opinion that the mill can be furnished with 50 tons of ore per day from the deepest workings. At the bottom of the Baker shaft, which is 340 feet, there is exposed a vein of free-milling ore of higher grade than any found elsewhere in the mines. The ore-body is not sufficiently developed to establish its permanency, but every evidence shows it to be a continuation of a true fissure vein.

The level run from the Baker shaft north in the Silver Girt vein begins at a point in the shaft 207 feet below the surface, and connects with an incline air-shaft 263 feet distant. This level is in ore the entire length, the vein averaging about 4¼ feet thick. The walls and the geological characteristics are the most favorable known for permanency and richness. The south level, starting at the same depth from the Baker shaft,.has been run 231 feet south, where connection has been made with the old workings of the Gunsight vein, giving a depth of 300 feet below the surface, the entire shaft of 300 feet in depth being all in ore.

On the Burro Burro mine hoisting works have lately been erected, worked by a San Francisco Hawkins engine of 15 horse-power. Two hundred feet of drifting have recently been made north and south—100 feet north at a depth of 79 feet, and 100 feet south at a depth in the shaft of 99 feet—with topping seams of good ore that averages 25 per cent. of copper and carries considerable gold. They are now running a drift to make connections with the air-shaft and the north drift along the vein. They are also stoping out in the old Burro Burro ledge with good results. Two reverberatory furnaces have been erected. The stack is 50 feet 8 inches high by 5 feet square at the top. It rests on a 9-foot base. The flue is 3 feet square and lined 18 feet high with fire-brick. The furnaces are of the most modern and improved design. They are elliptical in shape, the transverse axis being 17 feet long and the extreme width 9 feet. The width at the end of the fire-box is 5 feet and at the flue 16 inches. The extreme height of the arch on the west door section is 28 inches. The capacity of the new furnace is 30 tons per twenty-four hours. The furnaces are so arranged that they can be converted into melting furnaces without interfering with either oven or fire-box. A well 175 feet deep has been sunk in the neighborhood of the mine, and plenty of good clear water obtained, at an expense of about $2,000. Limestone for fluxing has been discovered in inexhaustible quantities 15 miles from the mine, which is an important addition to the facilities for reduction. Mesquite wood can be had, delivered, at $5 per cord. There are about 300 cords now on the ground. The present output of the mine is now more than enough to run three furnaces, and a third mill has to be erected shortly. Ore crops out on the surface the whole length of the claim, and can be mined with small expense.

The Arizona Peerless, which has been confounded by some persons with the Peerless Group in the Quijoton Mountains, is situated in this district, some 35 miles west of Mount Ben Nevis, in a different range of mountains. The superintendent reports having reached a depth of 150 feet, and struck a ledge 4 feet wide, on which work is being actively pushed.

The Arizona Central Mining Company, formerly the Vulture, is still running its 80-stamp mill, with all the necessary steam-power and labor-saving appliances, cars, tracks, self-feeders, &c., so that no hauling is necessary at the mines. There is also an air compressor to supply the mines with good air and furnish the power for the Burleigh drills. The water is pumped up from Seymour or Pump station to an eminence of 300 feet, and flows by gravity from there to the mill in 7-inch iron pipes. To get the supply at Seymour, it is piped in iron 5 miles to a reservoir, and from this a large compound Davy engine and pump of 50 horse-power forces it to the 300-foot elevation. This machinery and the mill have been running two and a half years with excellent satisfaction and without accident. The immense labor of this pump is shown in the fact that each twenty-four hours the mill and the town require 250,000 gallons of water. The daily consumption of wood at pump and mill is 25 cords, worth $6 per cord at the mill. Next year they expect to burn petroleum instead of wood. The 80 stamps never cease for months at a time. The daily capacity of the mill is 240 tons. The ore is free-milling gold rock of low grade, amalgamated in the battery, and amalgamated plates outside the battery. No other devices or concentrators are used for saving the gold. The mine is now employing 110 men, including those employed in the mill.

The Garcia mine, about 6 miles above Seymore and about a mile from the Hassayampa, was discovered recently, and is turning out well. The lead, which was but 18 inches on the top, has widened to 4 feet at a depth of 30 feet, which has now been reached. The ore is free-milling gold quartz. Forty tons were recently worked by the Vulture mill, and netted over and above the expenses of mining, hauling, and milling $1,000.

The Happy Jack is continually improving, and is now taking out very rich ore from a 5-foot vein, at a depth of 92 feet. Only a few feet from the main ledge a parallel has been found 10 inches thick which has given assays ranging from $300 to $3,000 per ton.

In *Cave Creek district* rich strikes have been made in several claims, in consequence of which many mines have commenced work and prospectors are on every hill.

The Ithaca Consolidated mines on Cave Creek are making fine progress. A sample of ore from one of this group is exceedingly rich in black oxide of silver. There is a large body of this rock.

The Phœnix and West Side mine shows good milling ore.

The Golden Fleece has a shaft down 10 feet below the 50-foot level, and the mine has opened up wonderfully well. The lead is about 20 feet in width, and 150 tons of ore on the dump show that the property is good.

Mr. R. J. Holmes says of the Right Bower: "It is situated in Cave Creek district, near where Yavapai and Maricopa Counties join, about 12 miles from Gilette, and has been opened by two shafts, one down 100 feet, the other down 160 feet. A cross-cut 50 feet down from the surface showed a ledge 15 feet wide. There are 1,000 tons of ore on this dump, which will go not less than $40 per ton in gold."

At the McShackerty mine a clean-up from 5 tons of ore worked in an arrastra yielded $60 in gold, or at the rate of $12 per ton. The ore was taken from the entire width of the ledge, which is about 80 feet, without assorting, and the yield is satisfactory. This mine has developed a mineral deposit that warrants the erection of a mill.

The Quien Sabe mine also shows well in free gold and permanency of ledge matter.

The shaft in the Bluebell mine, a half mile northeast of the Phœnix, is down 18 feet, and shows a good body of free-milling gold rock, averaging $20 to the ton. The lead is between porphyry and slate walls, an indication of permanency.

On the Buckeye mine the shaft has attained a depth of 42 feet, piercing the foot wall of the vein, which dips to the east about 45 degrees. They are now running with the vein a body of gold ore that will mill on an average $25 to the ton.

*Magazine district.*—The Red Rover has a shaft down over 100 feet, exposing a large vein of rich carbonate and chloride ore. Several tons of this ore yielded over $500 per ton. This is a very reliable property.

The Panther Mining Company own the Panther and the Carbonate Chief mines. They are both large veins and are opened by several shafts and tunnels.

The Rackensack mine shows a 10-foot vein of exceedingly rich quartz.

The Golden Star has had a mill erected on it, and has produced over $20,000.

The Lion is also a fine prospect, showing a 3-foot vein of quartz from which over $10,000 have been taken.

The Hunter's Rest, Chico, Maricopa, Catharino, Maggie May, and Joliet are among the many other promising mines in this district.

*Winnifred district* is about fifteen miles north of Phœnix. The ledges are a gold-bearing quartz, and some of them have produced very rich ore. The Grand Canal quartz mill had been closed, but is now running again. About 60 tons of ore are on hand and more are being put on the ground rapidly from a group of mines 15 or 20 miles north of Phœnix in this district. The mill is running five stamps. The Scarlet, Gila Monster, Red Dog, and San Diego all show good ore. The several silver ledges in the White Pecache Mountains bid fair at no distant day to increase the prosperity of the Cave Creek Valley.

Major C. H. Tail has made a new discovery near Wickenburg. The ledge is large and well defined, and can be traced for 1,000 feet on the surface. It is a smelting ore carrying a large percentage of lead. There is an abundance of wood and water in close proximity to the mine, which is two miles from the Hassayampa and Wickenburg road. A car-load of ore will be sent to Benson and a working test will then be made. The croppings assay from $18.85 to $336.25 per ton.

I have estimated the production of this county at: Gold, $330,000; silver, $25,000; total, $355,000.

## MOHAVE COUNTY.

The Atlantic and Pacific Railroad, completed this year, passes through the richest mineral-bearing region of this county, affording cheap transportation and rendering accessible the numberless ledges of metal of the many varieties produced in the Territory. These advantages are attracting capital and skill, and mining has been given a new impetus.

The necessity for cheap transportation is especially evident in the increasing shipments of low-grade ore, as hitherto only ore of a very high grade could be shipped with profit. The demand for lead ores in the San Francisco market has stimulated the production of this mineral, of which there appears to be an unlimited reserve.

*Hualapai district.*—This district, which includes the town of Mineral Park, is in the Cerbat Range, about 35 miles east of the Colorado River. The Atlantic and Pacific Railroad passes down the valley on the east of the range, and the different camps are from 10 to 15 miles distant. There is an abundance of wood for milling purposes, and in nearly all the principal veins water is found as depth is reached. The formation of the district is generally a granite and a porphyry. The ore is of high grade, and the veins are compact and regular.

The Lone Star mine, near Mineral Park, has been opened to a depth of 200 feet, and has produced a large amount. The ore is a sulphuret and very rich. The vein is small but regular. Work is being pushed on this mine.

The Keystone, in the same neighborhood, is a ledge of similar character. It has been opened by several shafts, the deepest being 250 feet. A rich strike was recently made on the 150-foot level. This body of ore is 3½ feet wide, assaying between $240 and $250, and contains a rich streak about 6 inches wide, full of ruby silver, and estimated at from $500 to $1,000 per ton. Two Burleigh drills, air-compressors, and new hoisting works are about to be erected.

The Alpha is developing into a very fine mine; a depth of 120 feet has been attained in the main working shaft. The pay ore in the shaft from the surface down will average about 3½ feet. Like other mines in this vicinity the gangue is very much wider. The Alpha produces some very high-grade ore, assays of selected samples going into the thousands, the average of entire pay stratum going in the vicinity of $100 in silver, with a good percentage in gold.

The Fairfield is on the same vein as the Keystone. It has been opened by a tunnel over 1,200 feet in length.

The Ithaca, southeast from the Keystone, shows a ledge 2 feet wide, from which chloride ore has been taken that will assay $70 per ton. It is opened by several shafts, drifts, and tunnels, and has been a valuable producer.

The Mineral Park mill is still crushing rich ore. Beside the company's ore from the Keystone and Quick Relief, there is a considerable quantity of rich ore being brought in by chloriders.

*Chloride Camp* is about four miles north of the Park, and has yielded a great deal of rich ore.

The Connor mine has been opened by a shaft of 100 feet, and the Donahue, Rodgers, Empire, and Valley View by shafts of less depth.

The Schuylkill mine is looking well. There are three feet of solid galena in the face of the drift. Ore is being taken from it at the rate of a ton and a half a day per man. The ore will average 25 to 30 ounces in silver, and over 50 per cent. in lead. The adjoining claim has been recently purchased by the company, and surface indications on this claim are better than on the Schuylkill. The deepest shaft is down 20 feet, but the vein has been opened at intervals for almost its entire length, and the showing is excellent; in one place there are 4 feet of solid galena and almost pure white carbonate, sampling from 48 to 51 per cent. lead, and 24 per cent. silver.

In the Rather mine the ore streak is about 4 feet wide and averages from $18 to $66 in gold and silver, besides carrying a large per cent. of lead. About 18 inches of the vein is heavy galena assaying from 35 to 40 ounces in silver, and from 50 to 70 per cent. lead.

On The Luckahoe mine a shaft has been sunk 70 feet and an 8-inch vein of rich sulphuret ore containing ruby silver has been found.

On the San Antonia good paying ore has been found.

At *Todd's Basin*, four miles south of Mineral Park, there are many fine properties, as yet only partly developed.

The Rainbow has four different openings, carrying gold, silver and galena.

The New London is down 100 feet, and the owners are shipping ore to Pueblo..

Messrs. Carty and Greenfield are at work on a new discovery a mile south of the New London mine, which has great promise. The lead is 4 feet wide at a depth of 12 feet; the pay streak of carbonate ore averages $33 in silver and $16 in gold per ton ,carrying 68 per cent. lead.

Messrs. Westlake, and Brady, of Albuquerque, have purchased the extension of the Golconda mine and are taking out some rich ore.

The Oro Plata has a tunnel of ore 100 feet, and a 14-foot vein of milling ore, averaging $50 per ton.

*Cerbat Camp* is 7 miles south of Mineral Park. The ores are of a high grade, the ledges are regular and well defined, and wood and water are found in sufficient quantity. The completion of the railroad has encouraged development, and this promises to be one of the busiest camps in the county.

The Fontenoy has been opened by two shafts, one being over 100 feet deep. The vein is 2 feet wide, and assays $100 per ton.

The Cerbat is a strong vein of sulphuret ore, and is opened by several shafts.

The Seventy-eight carries some very rich chloride ore. The mine is said to have produced over a quarter of a million of dollars. The average of the ore shipped to San Francisco has been $350 per ton. This claim is more thoroughly developed than any other in the camp, showing over 1,000 feet of shaft and tunnel.

The Flores carries gold and silver, and is opened by 300 feet of shafts and tunnels.

The Black and Tan has a 250-foot shaft, and shows a 2-foot vein.

The Champion mine has been shut down, owing to litigation. This mine has been making regular shipments of galena ore. The Silver, the Vanderbilt, Bay State, and Tulare are fine prospects.

*Stockton Camp* is 3 miles east of Cerbat, on the range above the rich Hualapai Valley. It is 7 miles from the railroad, and is delightfully situated. The veins are silver bearing, and there is plenty of wood and water.

The Cupel mine is being steadily developed, and arrangements are in progress to deliver 20 tons of high-grade ore to Chamberlain's sampling works at Kingman. This mine is said to have produced over $150,000. It shows a 2-foot ledge, and is opened by 500 feet of shafts and drifts. A good streak of ore has been struck in the face of the 10-foot level of the mine. The ore streak is from 4 to 8 inches in width, and will assay in the neighborhood of $400.

The Fountain Head is situated on the north side of the mountain, south from Cupel Cañon, and one-fourth of a mile due west from the Cupel mines. It is a 1500-foot location, with a general trend of northwest by southeast, and a slight westerly dip. The vein matter of this mine is not less than 12 feet, and the ore vein, as shown in the two shafts, 1,000 feet apart, is 3 feet in width. Shaft No. 1, 200 feet from the southern bounds, is down 30 feet, and shaft No. 2, 800 feet north, is 55 feet in depth, the vein in one being almost a *fac simile* of that in the other. The ore, of which there are some fifty tons on the dumps, carries about 25 per cent. lead, and averages, from actual working tests, $40 per ton in silver, with a small percentage in gold. The Fountain Head is a contact vein, lying between granite and porphyry. At the northern end of the mine a fine spring of water has been developed.

Almost due west, and a half mile up the mountain, is the Blue Bell mine; a large ledge, which crops out of the country rock, at intervals, its entire length. This mine has a considerable development, cross-cutting, &c., demonstrating that it is of large size, the vein matter being not less than 20 feet in width. Four hundred feet from the southern boundary a shaft has been sunk 60 feet, in ore all the way. One thousand feet north is shaft No. 2, 25 feet in depth. The ore vein in this shaft is about 2½ feet in width, and some 15 tons of ore are on the dumps. The ore is a chloride, and averages about $75 in silver and some $20 per ton in gold. The formation is the same as that of the Fountain Head, what miners call "friendly rock," being easily worked.

The Charlotte is situated about one mile southwest of the Blue Bell, and is on the western slope of the range, near Todd's Basin. It consists of two parallel veins, some 75 feet apart, the widest stratum being about 10½ feet apart. The ore is chloride, carrying no appreciable quantity of lead, and, assorted, averages about $175 per ton.

The Silver Monster ledge is appropriately named. There are two prominent locations on it, besides several extensions—the Cincinnati, owned by a syndicate of New York capitalists, known as the Fairfield and Cincinnati Company, and the Silver Monster, owned by the Grey Brothers.

The Cincinnati, 50 feet from the line of the Silver Monster, has a shaft 150 feet in depth. In this shaft three cross-cuts have been made at the depth of 50 feet, 150 feet respectively, and all are in ore.

The Silver Monster has a shaft 35 feet in depth. The ores of this ledge, which are of great quantity, are of heavy galena, low grade, and undoubtedly of a refractory nature.

The Miners' Hope is another ledge of immense size; the mineral formation is not less than 20 feet in width. It is situated on the crest of the mountain west of the Cupel, and crosses the summit obliquely, cropping boldly far down on both sides. It has been opened by a shaft at about the center of the claim to a depth of 70 feet. The pay vein, as shown the entire depth of the shaft, is 3 feet wide, and averages $90 per ton in gold and silver. The Miner's Hope is admirably situated in regard to working facilities, as it can be easily opened by tunnels or drifts running in on the ledge.

The Pure Metal is a vertical ledge, in the same formation as the mines described above, and holds the same general course. While having a big formation, the ore vein proper is about 3 feet wide, and is, as its name indicates, a vein of almost pure metal, running 80 per cent. in lead and carrying about $25 per ton in silver.

The Infallible and I. X. L. have shipped some ore, while the Sigma, Prince George, and the Little Chief are promising claims.

The mines of *Stockton Hill* have labored under great disadvantages, owing principally to the isolation of the camp and the great difficulty in procuring the necessary provisions, powder, tools, and machinery essential to the proper development of a mining district. These supplies are now to be had at very low prices, as a railroad passes at the foot of Stockton Hill. Lumber sawed in the mills of the San Francisco Mountains can be delivered at a point 7 miles from Stockton at a cost of about $25 per thousand, and coal from the mines of New Mexico at $10 per ton. The great mass of the ore is of low grade, but is found in immense quantities, the character of the country rock indicating the presence of an ample supply of water, while Oak Creek is within 5 miles of the principal mines.

Other valuable properties in this district are the Southern View and the Grant and McGeary mines. These are, however, only a small portion of the ledges found in this district. Many others have been located which may develop into paying mines.

In the Testo a 2-foot vein shows, at the depth of 18 feet, ore containing 84 ounces of silver per ton.

The Hualapai Queen, from a 2-inch pay streak at the surface, at a depth of 8 feet developed into a 2-foot vein, interspersed with sheets of antimonial silver, assaying 368 ounces in silver and $18 in gold per ton.

*Maynard district.*—Included within its boundaries are the highest peaks of the Wallapai Range, rising 9,000 feet above the sea-level. The high altitude makes the climate delightful, healthy, and invigorating, and though the miner may in winter find more snow than he likes, he is more than compensated by the cool days of summer.

The general formation of Maynard district is mostly in granite. The ledges are large and well-defined, varying in width from 2 to 20, and sometimes 30 feet. The ore streak measures from 6 inches to 6 feet, and the ore is generally chloride and carbonate on the surface, changing at a depth of 50 or 60 feet to sulphurets. Considerable galena ore is also found, notably in the Antelope mine.

The ores of this district are rich in ruby and antimonial silver, and vary from 50 to 1,500 ounces.

This district also contains an abundance of wood and water, a large portion of it being covered with heavy pine timber. Lumber required for mining purposes is easily procured at reasonable rates from the sawmills of the district.

In the early part of 1863, John Moss, with others, while prospecting through Union Pass, which lies on the east side of the Colorado River, discovered and located the Moss mine.

This mine is situated on a gold ledge, and was the first location made in Mohave County, in what is now known as Maynard's district. The rich specimens of gold taken from this mine, when exhibited in San Francisco, created great excitement, and resulted in the sale of the mine for $90,000.

The discovery and location of this mine resulted also in the formation, by mining men in San Francisco, of another prospecting party, which, in the fall of 1864, prospected through the Union Pass and Wallapai Ranges, finally locating on the western slope of the Wallapai Mountains, where they formed a district under the name of Wanba Yuma, which included within its boundaries the entire Wallapai Range, of which Maynard district now forms a part. After working some two or three months, this party was driven out by the Indians.

In the year 1866 the same party returned, and for several months worked on two of their locations, but were again obliged by the Indians to leave the district.

Little or no mining was done from this time until 1870, when several small parties ventured into the mining country and formed settlements at Mineral Park, Cerbat, and Chloride.

Lieutenant Wheeler, of the United States Geological Survey, having been detailed to report on the geological and mineral formations of the county, visited it for the first time and surveyed the present sites of Fort Mohave and the Indian reservation.

He again visited this county in the fall of 1871, and for several days camped on the main wash, running in the valley from the Wallapai Mountains, which has since been called "Wheeler's Wash."

With this expedition came also Major Wheeler, a brother of the lieutenant, and a party of prospectors outfitted by San Francisco capitalists. A house was built at Wheeler's Wash and a permanent camp formed, which was christened Bottle Camp.

A new district, Maynard's, was formed. Regulations and by-laws were adopted, and Francis Klett was elected as recorder. The first location made by this party was named Wheeler's Ledge.

The most prominent mine in this district, located in October, 1874, is the American Flag. The main shaft is 250 feet deep; there are two tunnels, one 691 feet long, tapping the shaft at 250 feet, and the other 603 feet long. There have been about 3,500 feet of drills, tunnels, winzes, &c., run in this mine. The production has been about $130,000. The ore is sulphuret, carrying pyrites of iron, some zinc blend, and a slight percentage of lead, the silver being antimonial and ruby, a streak of the latter ore about 4 inches in width which will average over 1,000 ounces to the ton. There has been more work done on this mine than on any other in Mohave County. The mine has been opened up with a view to its future working rather than to getting out what was in sight.

Another promising mine is the Mississippi, which has a tunnel about 420 feet long and a shaft 250 feet deep, at the bottom of which the pay streak is fully three feet wide, and will average over $50 per ton. Thirty tons of the best ore from this mine milled $900 per ton at the Mineral Park mill.

The Antelope is opened up by about 400 feet of tunneling and a shaft 100 feet deep. The ledge is 5 feet wide, of carbonate ore on the surface, carrying a good percentage of lead. Below the water level the ore changes to a heavy sulphuret. Ore from this ledge will assay from $25 upwards. Considerable of the best ore has been hauled to the mill at Mineral Park and all of it run over $300 to the ton.

One of the finest locations in this district is the Dean mine, with a strong, well-defined ledge 20 feet in width, with hard blue granite walls on either side. On this ledge there is a shaft 140 feet deep, with 5 feet of ore at the bottom which will average fully $80 perton. There is also a tunnel which cuts the ledge at a depth of 400 feet showing similar ore, in extent and value, to that found at the bottom of the shaft.

In Music Mountains a rich strike is reported; large quantities of $200 rock are being taken out and hauled to Hackbury for shipment to Argo, Colo. The mines in these mountains are promising. The ore is free-milling gold quartz, running from $40 to $500. The greatest drawback to the profitable working of these mines is the scarcity of water, which costs the miner 13 cents per gallon. Much of the ore is shipped to Eastern reduction works.

Hackbury Camp is in the Peacock Range, about three miles from the railroad. For a long time after the discovery of the Hackbury mine this was the most prosperous spot in Mohave County.

Hackbury mine, a body of ore 4 feet thick, was recently encountered in the mine on the 500-foot level, which assayed over $400 per ton. There are 37 men employed in the mine besides 17 in the mill. They are sinking for water in order to keep the mill running. The mine is looking well everywhere, and is being opened out in every direction.

Maynard district, with its large tracts of mineral land as yet scarcely prospected, its immense ledges, its high-grade ores and the facility with which they can be worked, together with the fact that the Atlantic and Pacific Railroad now actually passes within 12 or 15 miles of its mines, offers to the prospector advantages not to be excelled.

*Minnesota district.*—Of this district, formed December 27, 1880, less is probably known than of any other district in the county. This is probably due to its isolated position, lying, as it does, out of the usual course of travel. The nearest settlement or mining camp is El Dorado Cañon, which lies on the opposite bank of the river some 10 miles from the mines.

*Mineral Park* is some 40 miles from the district in a southerly direction. The general character of the country may, in its truest sense, be termed desert, the entire area included in its boundaries being devoid of both wood and water, and containing nothing in the shape of vegetation but cactus and brush, with the exception of cottonwood and mesquit woods which are found on the banks of the Colorado River.

Of the mineral wealth very little is actually known, as little prospecting has been done. It is, however, well known that many well-defined ledges, varying from 2 to 20 feet in width, do exist, and though mostly of low grade, some of them contain bunches of very rich ore. The little work done in this district consists mostly of getting out a few of these bunches, which were taken to the Lincoln mill at El Dorado for reduction.

On the 1st of January, 1883, this district was relocated under the name of *Ontario.* About the first location made was the Old Jennie mine. Some rich rock was taken out and, on being worked at Lincoln mill, proved so valuable that the Lincoln Company purchased the claim. A shaft was sunk 30 feet deep, besides considerable surface work being done, and at the end of six months between $6,000 and $7,000 had been cleared by the company. It however became involved in litigation, which resulted in the shutting down of the mill and everything connected therewith. Most of the ore taken from this claim during the short period it was worked by the company milled about $425 per ton. The ore was rich in horn silver. At the bottom of the shaft are 2 feet of rich ore, the rich pockets evidently not reaching that depth.

The Weaver mine has produced considerable ore. The work done on this claim consists of a shaft and tunnel, from which some 40 tons of ore have been taken out. The ore was worked at the Lincoln mill and run $125 per ton. The vein averages about 18 inches in width and the ledge is very spotted.

*Gold Basin* is 40 miles north of Mineral Park. The ledge is gold-bearing, the ore of a high grade, and free from base surroundings. A 5-stamp mill has been put up in this district which has turned out a considerable quantity of bullion. Water is scarce, but an abundant supply can be found at the Colorado River, some 30 miles away. A narrow-gauge road from the mines to the river has been projected. The supply of ore seems inexhaustible, and with cheap facilities for its reduction Gold Basin will become a very productive camp.

On the Harmonica the development consists of an 80-foot shaft and a drift 40 feet long. Work is carried on in the main shaft, and the ore continues to improve as depth is attained. The ledge has been cross-cut some 17 or 18 feet, but its full width has not yet been determined. Ore from the mine will carry from $20 to $80 per ton free gold.

The Northern Rule, Golden Rule, El Dorado, and Indian Boy are promising claims.

*Owen's district* is situated in the southern part of the county, near the line of Yuma. The discovery of the McCracken mine in the latter part of 1874 created a lively excitement, and a "rush" ensued to this part of the Territory.

The McCracken lode, which cuts across the country for several miles, is one of the great mines of the coast, and wherever opened shows from 5 to 40 feet in width. The ores are mainly chlorides and bromides, with some sulphides and galena. In the extent of its ore body the mine has few equals on the coast. For several years the McCracken was one of the leading bullion producers of the Territory, and the yield during the period of its activity reached over $1,000,000. The property is owned by a San Francisco company, who put up two mills, one of 20 and another of 10 stamps. The cost of supplies and the heavy charges on freight compelled the owners to suspend operations.

After a three years' stand-still the McCracken is about to resume active operations. The mill, containing 20 stamps, is undergoing complete repair. Those well acquainted with the mine think that it was as rich the day it stopped running as when discovered, and in confirmation a body of ore has been unearthed that is said comes up to, if not surpasses; anything before taken out.

The managers are determined to run their works to the best possible advantage, and to effect this men are employed building the road for the powerful steam-wagon now on its way from San Francisco, which is to carry the rock to the mill, a distance of 9 miles.

East of Owen's district, on Burro Creek, is the Burro mine, a vein of over 30 feet wide, carrying ore that assays from $5 to $300 per ton. There is a shaft down 250 feet, and several cuts. Messrs. Asbury and Wilkinson have made a new discovery on the west side of the Black Range, about 3 miles west of Union Pass station. It is reported that the ledge shows on top of the ground for a distance of 2,000 feet. Assays have been made of the ore taken out, which gave the following result: $135, $175, and $400.

*Cedar Valley district* is 60 miles east of the Colorado and about the same distance south of Mineral Park. There is a good supply of wood and all the veins carry water. The formation is granite, the ledge regular and continuous, and the ore sulphuret of silver. A 10-stamp mill has been put up in the district, and many of the mines show a large amount of development.

The camp has, with very crude and imperfect appliances for the reduction of ore, produced over $60,000. With careful and intelligent management this camp promises to become a steady shipper of bullion. The mines are all showing well.

The Arnold is a valuable prospect, and when the road now being built is completed machinery for a 10-stamp mill, with power for twenty stamps, will be purchased.

At the Bacon & Spear mill at Mineral Park a shaft is down 70 feet all the way in ore.

The Silver Queen and the Bunker Hill are promising mines.

*Aubry mining district.*—The following description is furnished by Mr. J. Logan, recorder of the district:

"The Aubry mining district is situated in the southern part of the country, and includes the southern extremity of the Wallapai range of mountains. Although the district was formed as early as 1873, for various reasons there has been little other than prospecting and assessment work done. The situation is favorable for mining purposes, and indications point to a promising future as regards the production of gold and silver. Wood, water, and grass are abundant. The roads are generally good, the quartz veins large, numerous, and easily traced. The Big Sandy flows through the district, furnishing both the farmers and miners with an abundant supply of water. Around Bowman's Peak (a lofty butte situated about 4 miles west of Sandy River and near the center of the district) is a perfect network of mineral-bearing veins of quartz. The most promising among them is the Aubry. This claim was discovered in 1875, and is 1,500 feet in length, as are all the others which I shall mention. Its average width is from 3 to 5 feet. Sinkings have been made in several places to the depth of from 5 to 10 feet, indicating at every place a true fissure vein. Recent assays from this mine show an average of $22.41 and gold $147.50. The Dividend and Arizona ledges are situated 3 miles north of the Aubry, and were discovered in the same year. The Dividend has several small shafts, the deepest of which is 20 feet. The ore at this depth shows an increase in width from 1 to 5 inches, and will work $150 per ton. The Arizona has about the same amount of work done on it, and shows 2 feet of ore that will work $50 to the ton. These ledges are from 3 to 4 feet wide, continuous and well defined. Some 20 other locations were made in the immediate vicinity, but no development on assessment work having been done they were forfeited by their owners. A great many of them, however, have recently been relocated. Among the recent locations are the Horn silver claim. This mine is situated one half mile south of the Aubry. The owners are at work taking out ore, a shipment of which has been made to Pueblo, Colo., for reduction, which yielded $400 to the ton. The high-grade ore is confined to a small streak, but the mine yields a considerable quantity of $100 ore.

"The Golden Star is a small ledge and is situated a few hundred feet northeast of the Aubry. The mine has a 6-inch pay streak of gold-bearing rock which assays $100 to the ton. The Eugene, one of the old claims recently relocated, is situated about 400 yards south of the Dividend mine. It is a 4-foot ledge. The ore assays $80 to the ton. There are also on this ledge two claims 1,500 feet in length. All of the above-mentioned mines carry auriferous and argentiferous lead and iron pyrites.

"The Wallapai Company, of Albuquerque, N. Mex., own some twelve or fifteen locations, and from what I can learn are all showing up well. On the east of the Big Sandy River, and within 1½ miles of it, are four or five locations of gold-bearing quartz. These ledges are from 1 to 5 feet in width and furnish an abundance of ore that will work $25 per ton. These are also relocations, and were formerly worked with arrastras, all the machinery being of the rudest description. Situated within a mile and a half of water-power of sufficient force to work the necessary machinery, these mines could, by skillful management, be made paying properties.

"Four miles southeast of these mines are what are known as the Borro ledges and mine. There are three locations on the ledge, which is from 20 to 40 feet in width, carrying a large quantity of free-milling ore that will pay from $40 to $100 to the ton; the ledge matter generally not paying more than from $4 to $10 to the ton. The ore could easily be worked on the ground, as wood and water for running the necessary machinery are near at hand. Four miles south of this mine, and 5 miles east of the Sandy River, is situated the old Greenwood mine, which was sold to a company in the latter part of 1874. A 10-stamp mill was erected, but for want of experience the owners failed. The ore from this mine worked in arrastras paid the original owners over $60 per ton.

The Greenwood is a large ledge from 5 to 7 feet wide, very favorably situated, and by proper management could be made to pay well. In the matter of wood, water, and grass,, three essentials to profitable mining, there is no portion of the county better supplied. The facilities for exploring the ledges are great, while the near proximity of the mines to the railroad makes transportation comparatively cheap. I will close by saying that among mines of this district there is much activity, and the coming year promises to be one of improvement."

I have estimated the production of this county for 1883 at, gold, $20,000; silver, $150,000; total, $170,000.

## PIMA COUNTY.

This county has experienced a wonderful influx of mining men and capital during the year, and its mines have never looked so well as at the present time. This is particularly true of Oro Blanco, Total Wreck, and the Santa Ritas. Since the discovery of the mines at Tombstone no such ore-bodies have been found within the Territory as those of the Quijotoa Mountains. Gold, silver, and copper are found in almost every mountain range. Granite and porphyry are the prominent formation, but lime, slate, and eruptive rocks occur in certain localities. The ores are mostly of high grade and the ledges well defined and compact. The erection of a custom mill and smelter at Tucson would be of great benefit to the owners of mines tributary to that city.

*Quijotoa district* is situated 70 miles southwest of Tucson, in Ben Nevis Mountain. This now famous "bonanza camp" is attracting as much attention among mining men as did the first discovery of gold at Sutter's mill in California in 1849. The following description of the Quijotoa mines is mostly taken from the Tucson papers:

### THE MINES,

which embrace the Peerless Group, and comprise the Peer, Peerless, Ibex Shield, Wild West, and Cholla, embrace six claims in compact form, 1,800 wide by 3,000 feet in length. The formation of the Quijotoa mines is in porphyry, which splits vertically, showing but few horizontal fissures; the lodes are in place, with a slight dip to the east; the mineral is found in quartz, spar, and porphyry; the capping is quartz; much of it has the appearance of conglomerate, which is caused by oxidation. The mineral belt is extensive, the ore is free, and there is every reason to believe that the mines will go down. All lodes run to the Peerless mine, and the same kind of ore is found at the base of the mountain on the Cholla that is found on the Peerless, over 1,000 feet above.

Mount Ben Nevis is one of the Quijotoa Range, through which the principal lodes extend, completely detached on the southeast, and only connected with a low range of hills to the northwest. In reality Mount Ben Nevis is a distinct mountain, 1,500 feet in length. It may be cut anywhere at the base by a tunnel a quarter of a mile in length, and can be so cut at a depth of from 600 to 800 feet below the outcrop on the top of the ridge, with a tunnel from 300 to 500 feet in length and at one point near the Peer (dividing it from the Peerless), either lode can be cut at the depth of 500 feet with 100 feet or less of tunneling; a tunnel of 300 feet will pierce the mountain through at the same depth. The average width of the ridge is about 300 feet, though it varies and at some places is not more than 100 feet wide. The first 800 feet from the base up is at an angle of about 45°, and from this point up to the apex of the ridge it is nearly perpendicular. The opposite side of the Peer and the north half of the Peerless is even more precipitious, and the precipice is nearly or quite 1,000 feet high; but at the southeast end of the Peerless mine, the cliff seems to have broken down, and it is at this point that the foot trail leads up on the west side of the mountain. From here southeast to end of the mountain, a distance of over a mile, the palisade is broken down, leaving a rough surface, which can be scaled only with great difficulty. It is as near as may be 4,000 feet above sea-level and one of the most rugged spots in Arizona. At the lowest point that can be reached on the northwest corner of the Peer mine, there is a short cut in the solid rock about 300 feet long and about 50 feet wide, which assumes the form of a miniature cañon, where it jumps the precipice, which is believed to be about 1,000 feet high.

### PEER MINE,

on the brink of the precipice, where it shows a ledge 4 feet wide—at this point it is 200 feet below the apex of the ridge—the lode runs right up the point of the ridge, passing on the west side of the same for a distance of 600 feet; here it runs along the west side of the precipice, where a cut is being run, and some fine ore is being taken out. The outcrop of the ledge, from the northwest end to this point, is regular and strong; it varies, as near as can be determined from a surface examination, from 4 to 6 feet in width, but at the cut above referred to the ore-vein is 5 feet wide and not yet cut through; the cut is about 12 feet deep. Assays from the breast of this cut gave $361.20 in silver per ton. The lode continues near the west brink of the precipice to the southwest end line, where the Peerless ground begins. The lode the entire length from the beginning at the northwest end to the end line of the Peerless is continuous, and good ore can be broken off almost anywhere along the outcrop that will go from $50 to $4,000 in silver per ton.

The Peerless mine, which begins where the Peer ends, has two distinct lodes at the northwest end, varying in width from 4 to 6 feet, and two smaller ones from 20 inches to 3 feet, embraced within a width of 60 feet. About 1,000 feet from this point all of the lodes seem to come together, forming one large lode that continues good and strong to the southeast end of the claim. There being no work done on this portion of the claim, it is impossible to give the accurate width of the vein after the lodes unite, but from the surface indications it must be 6 feet or more. Three open cuts are being run at the northwest end, near the rope tramway; two of them are on the east lode, and are but a few feet deep. The other is on the west lode and is down on the breast about 15 feet, showing a vein between 4 and 5 feet in width of excellent ore.

There are several other adjoining claims that are very promising. The Crocker, a continuation of the Peerless, the Cholla, Wadsworth, and Josh Billings, are silver prospects, and the Wedge, Emerald, and Murray copper mines.

The Emerald copper mine is considerably developed. There are two open cuts on the north end; the lower cut is in about 15 feet, breasting up about 12 feet in depth, showing a fine vein of solid ore 8 feet wide that will go from 15 to 20 per cent. in copper and about $60 in silver per ton. About 150 feet higher up is another larger cut, showing up a 12-foot vein of similar ore, which goes a little less in copper, but yields a higher rate of silver. It is thought that it will run into silver, and that the copper will give out as depth is attained, owing to its location in the midst of silver mines. It now assays $30 per ton in gold and silver.

The Quijotoa mines have been purchased by John Mackay and J. C. Flood, of San Francisco, who are developing and equipping the same upon a large scale. The principal drawback being the lack of water and fuel, the mines mill will most likely soon be supplied from the numerous deep wells now under process of sinking by approved machinery.

The Quijotoa group consists of 13 locations, comprising all the mines on the north end of Mount Ben Nevis. Four separate companies have been organized to work these mines. The names of the companies, together with the mines that belong to each corporation, are as follows: The Peerless Company, the Shield and Outlet, the Peer Company, on the same ledge as the Peerless, the Wide West, the Ibex, and the Intervenor mines.

The Weldon Company owns the Wadsworth and Cholla, which are situated from 1,000 to 1,500 below the apex of Mount Ben Nevis. The lodes are large and show high-grade ore.

The Combination Company owns the Combination, Wedge, and Josh Billings. The Josh Billings shows up a fine ledge and considerable good ore.

The Locomotive mine.—This mine, which joins the Peer mine on the north, but which is from 1,000 to 1,500 feet below, is said to be a fine prospect, ore having been found in places which goes from $20 up to $2,000 per ton.

The Quijotoa mine is supposed to be a continuation of the Peerless mine. On the face of the rocky bluff where the ledge is broken down there is a large amount of ore in sight which, it is estimated, will mill $40 to the ton.

The Papago Chief mine, which is also in the Quigotoa Mountains, about 6 miles northwest of the Peerless group, is a promising prospect. There has been but little work done on the lode, but a company has been organized and regular systematic work has begun. The croppings of the Papago Chief have been sampled on the surface to a depth of a few feet, when the ledge was found in place with most satisfactory results, the assays running from $124 to $2,267 in silver per ton. There are two lodes in this mine; the main lode is said to be 30 feet wide, and the other, which is about 400 feet to the south, is from 8 to 10 feet wide. A tunnel now in about 30 feet is being run to tap the main lode at a depth of from 160 to 180 feet below the surface, the work continuing day and night. It is believed that the lode will be reached with 100 feet more of tunneling. The Papago Chief Company have a well of good water 600 feet from the mine which is 60 feet deep and affords an average of 6 feet of water, which rapidly fills after being drawn out. They have also erected a house 20 by 30 feet in size, with sleeping apartments and capacity for 25 men, and a blacksmith shop, all within easy reach of the mine. Plenty of wood and grass are found everywhere. This mine is the property of a San Francisco corporation.

Silver Mountain mine.—A contract has been let for the sinking of a working shaft on this property. It is said to be a fine prospect. It is situated near the Papago Chief, and about 9 miles from the Peerless group in the Quijotoa range of mountains.

Silver bullion.—This mine is a recent discovery near Covered Wells, 8 miles north of the Quijotoa group. The ore resembles that of the Stonewall Jackson mine. This rich streak is from 3 to 6 inches wide, and is nearly pure silver. Outside of this is a ledge 1 foot wide that assays $800 per ton.

Among other locations deserving mention are the Great Republic, 20 miles south of Logan City; the Bonaza mine, 5 miles from Covered Wells; the Arizona mine, located a quarter of a mile from the Bonanza; the Brittle Silver, located about 4 miles north of Logan City, the Silver Glance, an extension of the Brittle Silver, the Jersey Lily, and the Gah-kotkh mines Nos. 1 and 2.

*Empire district.*—Mr. John O. Dougherty, superintendent of the Total Wreck mine, says:

"This mine has a working incline shaft sunk on it to a depth of 360 feet. The shaft follows all the way the course of the vein, which dips eastward at an angle of 25 degrees. The course of the ledge in its length is northeast and southwest. Levels at the depth of every 50 feet have been run on the vein from each side of the shaft, vary ing in length from 100 to 150 feet. In most of these levels very large lodes of ore were found and extracted, sometimes the vein of pay ore having a width of nearly 30 feet. Four steam hoisting works, capable of working the mine to a depth of 1,000 feet, are constructed on the mine.

"A 20-stamp mill, with all pans and settlers requisite, is built within a few hundred feet of the mine. This mill has machinery and steam-power capable of running 40 stamps. The present 20 stamps crush 70 tons of ore in the twenty-four hours.

"The water for the hoisting works and mill is taken from a cienega about 2½ miles distance from them. The water is forced by powerful steam pumping-machines to tanks capable of holding 100,000 gallons, which are built on a high knoll, about a quarter of a mile from the mill. From these tanks the water flows through 4-inch pipes to the mill, impelled by the force derived from its elevation. From the mill the water is forced by machinery to the hoising works on the mine."

At present the mill is closed and work on the mine suspended temporarily. The mine has not been opened sufficiently to keep the mill running, but on sufficient ore being exposed, it will again resume operations. The formation is limestone. The Total Wreck is within 7 miles of Pantano station, on the Southern Pacific Railroad."

The Tucson Citizen of a later date says:

"A rich body of ore has been struck in the lower workings of this mine, and the mill has been worked with a force of 90 men on the property.

"The mill is one of the most complete for the treatment of free-milling ore in the Territory, and is so located as to enable the transfer of the ore directly from the mine without long hauling. A large ore-car with a capacity of 5 tons conveys the ore from the mouth of the tunnel on a tramway around the side of the hill to the mill, where it is deposited in an immense ore-bin right over the rock-breaker, at a cost of 8 cents per ton for hauling. The mill has 20 stamps so arranged that 20 more can be added and the capacity of the mill correspondingly increased. The capacity of the mill as it now stands is about 65 tons daily. The mill is driven by a Corliss engine, having a 20-inch cylinder and a 48-inch stroke, and a fly-wheel of 14 tons weight and 18 feet in diameter. The engine is supplied with heaters and the latest appliances for economizing fuel and steam. The mill was constructed so as to use either the old or what is known as the Boss process. After trying the two side by side, they are using the latter process altogether, it giving better results and being more economical. There are fourteen pans and seven settlers, and by this process the pulp is run automatically right from the batteries to the pans. The pulp is run through seven pans and four settlers during which it is treated with the chemicals, quicksilver, cyanide, and a little salt. The character of the ore containing, as it does, a little copper, makes the use of bluestone unnecessary, and upwards of 90 per cent. of the value of the ore as shown by the pulp assays is saved and the bullion is upwards of 900 fine.

"It is the purpose of the manager to give both the Boss process and the old method a fair trial and adopt that which seems the most economical.

"The ore averages $87 per ton. It is taken from the mine without sorting; in fact, the character of the ore is such as to render sorting practically impossible. It is a rare thing for a mine to exceed its estimates, but it shows that the management did not practice self-deception in sampling the ores as the mine was being developed.

"The mine itself is looking unusually well. A new level has been run at 150 feet in depth, and a fine body of horn-silver encountered running up into the hundreds. The whole face of the drift averages over $100.

"From this level stoping has been commenced, showing a vein 20 feet in width. Cross-cutting on the 100-foot level has disclosed an additional ore-body still further to the northwest than any was supposed to exist on that level, an indication favorable to the value of the mine itself and full of promise for adjacent property in that direction.

"*The water-works.*—The great difficulty which the management has had to cope with has been the water question. They were compelled to go to the cienega for water, a distance of about 2 miles. There they have erected pumping works and pump the water 10,000 laterally and elevate it 540 feet, forcing it through a 6-inch pipe at the rate of 15,000 gallons an hour. The water is stored in tanks and runs to the mill automatically. The mill requires about 150,000 gallons per day, so that ten hours' pumping supplies the mill for twenty-four hours. The manager estimates the water costs 40 cents for every ton of ore milled. The supply is abundant, and as the engine consumes less than two cords of wood per day and requires but one engineer."

There is another mine in the district which has every indication of becoming a bullion producer. It is the Forty-Nine. There is a shaft sunk to a depth of 116 feet, which shows a large body of ore, 8 feet in width, which I am informed would average $30 a ton. There are about 300 tons of ore on the dump. This is a contact vein (a very favorable evidence of permanency), having a porphyritic dike for its foot wall and limestone for the hanging wall.

There are many other good prospects in Empire mining district, but no work done to prove their value. There is no other mill or smelting works in the district.

The John McKay.—This mine is about 3 miles southwest of the Total Wreck. Shaft No. 1 is down 50 feet, with a drift at the bottom along the foot wall of 40 feet. From this about 200 tons of ore have been taken, giving an average assay of $52 in silver, 62½ per cent. lead, and 12½ per cent. copper. Selected samples have given as high as $1,100 per ton in silver. Shaft No. 2 is down 50 feet in the same kind of ore, the vein of which is from 1 to 4 feet in width. There are four other openings on the claim, all showing the same class of ore. The ledge is iron capped; the capping in places is 10 feet thick. In all there are about 200 feet of development work on the property and 350 tons of ore on the dump.

*Arivaca district.*—The Cleopatra mine, in the Baboquivari Mountains, is rapidly coming to the front as a prolific ore producer, and is attracting much attention. This ledge is a contact vein, the hanging wall granitoid and slate, and the foot wall porphyry. The pay streak is about 12 inches wide. The owners are now preparing to ship ore, and have already sacked one hundred sacks, which will average about $100 in gold and $75 in silver. A smelter, or mill for reduction, is about to be built.

In the Baboquivari Range there are a number of fine prospects assaying from $50 to $100 per ton in silver. The most promising are the Black Hawk and the Silver Chief.

The Smile of Fortune mine is situated 65 miles south of Tucson. The ore is free-milling quartz, and runs $23 in silver. They are down 40 feet. The last 10 feet were made as a prospect. In the first 30 feet a $2,000 pocket was struck. At present there are only 2 tons of ore on the dump.

On the Inca Gold and Silver Mining Company several shafts have been sunk, the deepest being 120 feet, showing an ore-body from 5 to 12 feet wide at the bottom. There is an adit level on the vein which connects with the shaft at a distance of 195 feet. There are 400 tons of high-grade ore on the dumps. The ore is a chloride carrying gold, the average assays being $88 in silver and $34 in gold.

The Union shows a 4-foot vein of milling ore worth $50 per ton.

The Mentor has within its boundaries one of the largest veins of the district.

The Arkansas has a shaft down 150 feet and a 4-foot vein of chloride and sulphurets of silver.

Other mines here are the Arizona Consolidated, the Longarm, the Cerro Gordo, and Silver Queen.

*Oro Blanco district.*—The ores of this district carry silver and gold, and there is an abundance of wood and water for reduction purposes.

The Orion mill is running very successfully, day and night, on ore from the Montana mine belonging to the Orion Company. The ore is being worked to a high per cent. of the assay value. The Warsaw mill has recently started up on custom work.

The Esperanza mines are situated 6 miles north of the Sonora line and 2 miles south of the Warsaw mill. The ledge or ore-body upon which the success of the camp hinges is the famous Blanc or Inderstroth ledge, that within the past two years has become prominent because of its great size and free-milling gold ores. It is owned and controlled by a Boston corporation.

A 25-stamp mill is in course of construction. The Boss or continuous system of pulping and amalgamating is the process adjudged best for an economical working of the ore, and will consequently be the method of reduction used, the mill having been constructed with that especial end in view. Slum tanks and expensive labor will thus be dispensed with. The improvements are a 20-stamp mill, thoroughly equipped; a dam which will create a reservoir capable of containing water sufficient for a six months' run; a dormitory 20 by 50 feet, one of the best buildings of the kind in the Territory; a boarding-house and office, each 20 by 40 feet, and about a mile of well-built road. The motive power is to be steam. To guard against possible accidents to the contemplated water supply, a bulkhead has been built across the cañon above the mill, thus creating a reservoir of 15,000,000 gallons measurement. It will be filled by the winter rains. The bulkhead is a splendid piece of masonry, 120 feet long, 27 feet high, with a 32-foot base.

The Esperanza Group consists of the Emma, the Confidence, and the Bullion. To the latter two the company looks for its ore supply. The Confidence, the chief of the trio, is, so far as appearances go, an immense mine; the surface croppings are enough to run the mill for two years. It forms the crest of the ridge, and is 1,200 feet long by 450 feet wide. On the eastern slope of the ridge it crops strong to the depth of 75 feet; on the west side, 26 feet. The pay portion is believed to be a great kidney, covering an area of 450 by 250 feet square, into which a cross-cut has been driven to a distance of 45 feet, the entire distance being all in fair grade free-milling ore, of such quality as will insure a handsome return to its owners.

On the same claim, and lying parallel with the Confidence, is a second ledge, with croppings between 12 and 16 feet wide. The pitch of the vein is, as far as can be ascertained, in the direction of the main body.

The Bullion lies at right angles with the Confidence, and consists of three distinct veins of ore, one of which rises into an immense bluff, from which 500 tons of good milling ore have already been broken down for transfer to the mill.

The Emma claim lies on the east side, and runs parallel with the ridge. It has a width of about 18 inches and is said to be of a high grade. Connection between the mines and the mill will be made by means of a 900-foot endless cable with a grade of about 300 feet to the mile, a loaded car down taking an empty one up, the cars passing each other on a three-rail track, by means of a frog midway between the mill and Bullion Point, at the southern end of the Bullion claim.

The Franco-American has lately disclosed a very promising prospect. This mine runs nearly east and west, and is split in two diagonally by an immense syenetic, porphyry dike, about 10 feet wide, and in places about 25 feet above the surface. On the south side, and near the base of the dike, is a very large outcrop of iron and copper stained quartz, running parallel with it. There are several open cuts in the croppings, all of which show silver, gold, and copper. At one point there was a shaft 5 feet deep where three years ago assessment work had been done. In the bottom of this shaft, on the east side, some very rich ore was discovered, that assayed $520 in silver, $25 in gold, and 47 per cent. in copper per ton. The heavy cropping that stood over what appeared to be an ore-chimney just east of this shaft being shot off, considerable ore was exposed, that assays over $100 per ton in silver, and they now have several tons of ore on the dump that will average at least $200 in silver per ton and some gold and from 30 to 40 per cent. copper. The ore-vein is about 4½ feet wide and dips north at an angle of 90 degrees. In the vein there is a seam 6 inches wide of porous honey-combed matter that goes very high in silver and copper, and some of the quartz thrown out by the blasts shows considerable horn-silver that will go several dollars per pound.

A test has been made of 17½ tons of ore at the Orion mill, and the result was very satisfactory; a silver bar being produced which was valued at $794.49, which is a fraction over $47 net per ton. As the ore carries copper, the best results cannot be had from a mill-test. With the exception of copper, the ore is free; it contains no antimony, arsenic, or zinc, and may be successfully smelted.

The lode is nearly vertical, with one good wall; the shaft, which is 5 by 7 feet, not reaching the other. The lode has every appearance of going down.

A cross-cut has been started from the 50-foot level, which at latest reports was in 23 feet, and all the way in solid copper ore of good quality, that runs from 10 to 47 per cent. The ore is malachite and green carbonate of copper, with frequent deposits of red oxide and black copper, assaying as high as 33 per cent. and $200 per ton in silver. There is no waste from the cross-cut. There are about 75 tons of ore on the dump, which is being added to at the rate of about 3 tons a day

The latest news from the mine is to the effect that the shaft has been run down in valuable ore.

The Wateree mine.—The vein is said to be about 40 feet between walls, and is interspersed throughout with exceedingly rich stringers of carbonate ore, varying from 1 to 3 inches in thickness. All have a tendency to pitch towards a common center lower down. Should such be the case the future of the mine will be an important one, as the ore assays all the way from $200 to $600 to the ton. The mine is situated a short distance south of the famous Blanc mine near the town of Oro Blanco. Developments are being pushed forward.

The San José is opened by 400 feet of shafts, drifts, and tunnels. The ledge is nearly 100 feet wide, the ore occurring in seams. Some of this ore has assayed as high as $15,000 in silver per ton. Over $10,000 has already been taken out, and the work of development is steadily pushed.

The Old Stiff mine has produced 100 tons of ore, which at the Arivaca mill yielded at the rate of $100 per ton. As yet but little work has been done on this property.

The Nil Desperandum shows a strong vein of free gold, that has yielded $40 per ton.

The Ostrich, Hermann, Idaho, and California are all fine prospects. There are many mining claims here containing quantities of rich metal, and nowhere are the indications better than here for permanent mines.

*Harshaw district.*—In this district, a few years ago, several hundred thousand dollars in bullion were extracted, and a number of claims changed hands at good prices. For the past year or two it has been almost depopulated, but is again coming to the front with good prospects.

The Ben Butler is what was formerly known as the Alta. It was sold to some Eastern parties several years ago, and subsequently abandoned. It has lately been relocated, and about thirty men are at work on the mine; hoisting works have been erected and the water has been pumped out. The main shaft, which is down from 160 to 180 feet in good ore, has been timbered up and put in good working order, and is now being sunk deeper. A number of men are at work on the upper levels extracting good paying ore, which is being shipped to the Benson smelter for reduction. The owners are now satisfied that they have a paying property, which will become more valuable as it is developed.

The Home Again, formerly known as the Blue Nose, has been relocated and a fine body of ore developed, which is also shipped to the Benson smelter for reduction. Some beautiful ruby silver ore has been found in this mine, assaying as high as $800 per ton.

The Scott mine has been a regular shipper, and it is thought that the Hermosa mill will again start up on ore from the neighboring mines.

On the western slope of the Patagonia Mountains a remarkably rich discovery has been made. It is a mammoth ledge fully 100 feet in width, in which occur frequent stringers of native and horn silver. The owners are quietly developing their property.

In *Red Rock district*, which lies east of Harshaw, recent assessment work has uncovered some very promising ledges, and if reduction facilities were at hand a large quantity of ore could be extracted.

*Washington district.*—The Mowey Mining Company is pushing its shafts deeper daily. The outlook is very favorable. The Flux mine, which had lain idle for some time, has again been started up. It is near the New Mexico and Arizona Railroad, and a side track has been laid to accommodate the owners of the mine and to afford them convenience in shipping their ore. A great deal of development has been done here, and many attempts made to run the ores, but owing mainly to bad management these ventures have not proved successful. But the opening of the New Mexico and Arizona Railroad has lessened the cost of material, and no doubt many mines now idle will start up. Other mines here are the Davis, opened by several shafts; the Belmont, the San Antonio, the Holland, the Blue Jay, and the Grasshopper. With its large veins and excellent facilities for wood and water it is thought that the camp will soon become a steady producer of bullion.

*Silver Bell district.*—Has many fine copper properties, upon some of which a great deal of work has been done.

The Young America Copper Company has a 20-ton smelter, which is kept steadily at work, and has already turned out a large quantity of bullion. The ore-body in the mine is large and of a good grade.

The Southern Beauty is a copper mine, which is represented to be of much promise. An open cut, 10 feet wide, has been run in on the lode 50 feet; at the end or breast a cut has been run at right angles across the ledge 35 feet, all in red oxide and carbonate copper ore, which, it is said, assays from 18 to 25 per cent. in copper.

The Advance mine, in the same locality as the Southern Beauty, has a shaft down 30 feet on the lode, and at the bottom a cross-cut exposing an ore-body, as we are informed, 10 feet wide, of the same character of ore as that found in the Southern Beauty. A working test of 40 tons was made from the mine, which yielded an average of 26 per cent. in copper per ton.

The True Blue has two shafts, one 196 feet, the other 50 feet deep. At about 40 feet down two men are chloriding successfully and getting out some very rich ore. The whole of this western part of the district seems to be permeated with a regular net-work of veins, most of them visible on the surface and containing high-grade ore, but so little work has been done that it is impossible to predict the future of these mines.

The Arizona, the Surprise, and the Mayflower are copper mines which have been prospected to a limited extent and show a good character of ore.

The Blue Coat, the Old Boot, the Navajo, and Aztec have been patented.

*Tyndall district.*—The mines of this district are situated south of the high peaks of the Santa Rita Mountains, 60 miles south of Tucson. The mines are favorably located near the Santa Cruz River, and there is plenty of wood. The camp has suffered much from bad management.

The Dayton mills and the Tizwine have shafts from 50 to 100 feet in depth and carry gold, silver, and copper. The California, the Congress of Beauty, the Thunderer, Delta, Bradford, Sandwich, Magnolia, North Star, and a large number of other promising properties are in this district.

A number of miners are working a promising claim about 20 miles from Tucson, near the cienega on the Southern Pacific Railroad, this side of Partano. The mine is but a little more than a fourth of a mile from the railroad, and good facilities abound for working the ore when the mine shall be sufficiently developed. A shaft is now down about 50 feet, and a 2-foot ledge has been encountered carrying gold and silver in paying quantities.

*Wrightson district.*—The West Virginia and Arizona Mining Company have purchased the Gringoire mine and several adjacent claims, situated in Temporal Gulch, which head near Mount Wrightson, and run south for a distance of 12 or 15 miles. Development had been begun when, at the depth of 100 feet, water was encountered and operations ceased.

Pumping machinery is now being erected, and a wagon-road built from Crittenden to this mine, 4 miles distant. Quarters for miners will be erected and the properties developed as speedily as possible. The Gringoire has a large, well-defined ledge, running its entire length. The ledge is white quartz, carrying free gold in paying quantities, and also some silver.

The Mansfield group, farther up the gulch, has been sold to a good company, but operation has not yet begun.

The Rupert mine is on the same ledge; ore is being taken out which yields $250 per ton.

The Silver Cave mine, which is situated near the head of Temporal Gulch, was discovered last July. Considerable development work has been done on the mine, and a small force of men is at work. We learn that the mine is looking well. The ore is yellow and gray carbonate, and assays $60 in silver and $5 in gold per ton. The ledge is about 2½ feet in width, and shows the same class of ore at different places nearly the entire length of the claim. Should this mine develop as it now promises to do, the owners will soon erect a 5-ton smelter, as the ore is free and of sufficiently high grade to warrant it.

At Williams Basin, 1 mile above, ore for shipment is being taken from the first eastern extension of the Bullion mine. The ore is gray copper and galena, very rich in silver and gold. The Bullion ledge can be distinctly traced for a distance of 3 miles, and at different points where it has been opened the ore is of the same character. The ledge is a contact, the country rock being porphyry and syenite.

A very rich mine of native silver and copper has been found about 3 miles above Gardner's ranch in the Santa Ritas. The silver is so soft that it can be cut with a knife.

*Greaterville district.*—Mr. P. J. Coyne, of Greaterville, furnishes the following information relating to mines in his district:

"This camp was organized about seven years ago, and has been made by the placer diggings self-sustaining. Considerable gold was produced during the first three years, and the annual production during the last four years has been about $12,000. There is no capital interested in this district, as water is very scarce, and the mines of the vicinity are all worked by poor men. The mines developed are as follows: The Yuba has an incline shaft 70 feet deep; pay streak, from 6 inches to 1 foot; ore all on the dump. The Shamrock has an incline shaft 70 feet deep, a pay streak as in the Yuba. The General Hancock an incline shaft 100 feet, deep ore all on the dump. The Alla incline shaft, 80 feet, ore on dump. The Montreal incline shaft, 70 feet, ore all on dump.

"There have been some specimen assays of the ore from the last-named mine of over $3,000. It is chiefly free-milling ore. The Domingo has an incline shaft of 100 feet. The pay streak is 1 foot wide, in a limestone formation. The ore is a chloride, with an average assay of $70. The Florida is a copper mine, situated about 7 miles from here, in the Santa Rita Mountains. There has been considerable work done on this mine, showing native silver. The property is owned by parties in Council Bluffs. There are over 100 mines located in this district."

In the Sierritas Mountains is the Saragossa mine, 37 miles southwest of Tucson. It was located over a year ago by P. Garcia, but a vaquero last June rediscovered and made known its richness. Subsequently the mine passed into the hands of Messrs. Stephens and Garcia. The general course of the ledge is northwesterly and southeasterly, and can be readily traced for 300 yards. The gangue is a porphyritic quartz-slate on one side; the hanging wall is lime. It is a well-defined true fissure vein, with hanging and foot walls. The ore is copper and silver glance, carrying also a large proportion of rich chloride of gold and silver. The assays averaged $135.40 in silver and 12 per cent. copper per ton.

The Silver Crown mine is 35 miles south of Tucson, in the Sierritas, and is owned by the Silver Crown Mining Company. The ore is in quartz. Average assays are $128 in silver and $20 in gold. In another part of the same mine a true fissure vein has been found 4 feet wide. This contains a pay streak 2 feet wide that assays $350 in silver. This mine has a 50-foot shaft and a 25-foot tunnel.

The Gloretta is a free-milling gold mine near the Saragossa. Its ores are crushed in Tucson.

*Aumole district.*—Considerable development goes on here. Generally speaking the ores of the district are low grade, but abundant, yet in some instances exceptionally fine ore has been found in small quantities. A little free gold has been seen in the rock from the hills, together with silver, a trace of copper, and some nickel. About 10 miles to the southwest, not far from the Altao road, parties have opened up a good body of lead carbonate that, at a depth of 30 feet, averages across a 10-foot ledge over $30 in silver and 40 per cent. lead. Others in that neighborhood are opening up bodies of similar ore, and have discovered strong ledges of fine appearance, crossing the mesa lands in the direction of the San Xavier Mountains. The croppings indicate fair deposits of carbonates that may become quite valuable for fluxes, particularly as they carry lime and iron in moderate proportions.

The Buena Vista mine is situated about 8 miles southwest of Tucson. An important strike has recently been made on it. There is a large outcrop of what appeared to be barren quartz which passed up the north end of the hill over which the lode extended. The owners concluded to do their assessment work here, and discovered a fine body of black petarque and copper ore, at a depth of less than 15 feet, which assays high in copper and silver. A number of tons of good ore are already on the dump. The owners will make a shipment to Pueblo for the purpose of making a test, and if it proves to be profitable, shipments will be made.

The Little Watson mine is 10 miles west of Tucson, adjoining the Buena Vista. It carries carbonate of silver and lead. Average assays go $45 silver and 40 per cent. lead. Two men were put to work very recently on this mine.

*Silver Hill district.*—The Tucson Star publishes the following concerning the Abbie Waterman Group:

"The old tunnels started about a year ago have been carried through to the ledge and the cross-cut made from the hanging to the foot wall. The hanging wall carries with it a streak of rich gray sulphur carbonate, and the pay streaks on this side consist of sand carbonates assaying pretty well up. This is the character of the ore that created such excitement at Leadville, Colo. A shaft has been sunk on the ledge, which is 4 feet wide, to a depth of 110 feet. The ore is sulpho-carbonates and will average 50 ounces in silver and 38 per cent. of lead.

"The Amelia, the first extension south of the Abbie Waterman, has a shaft sunk to the depth of 30 feet, and the work of sinking still continues. The bottom of the shaft is all in ore of the same character as that found in the Abbie Waterman.

"There is in the vicinity an abundance of wood. A large body of water only 5 miles distant rises nearly to the surface of the mine. At this point the different companies have located mill-sites, and from all accounts it is quite probable that a furnace will be erected at this point before long. The immense bodies of carbonates and the many facilities for making them give the district many advantages over other districts not so favorably located."

*Tucson district.*—Midway between Calabasas and Lime City lie the Albany, Baltimore, and the Mohawk. A good natural road connects them with these towns.

In the Albany the ledge crops up clear and bold along its entire length, and is between walls about 4½ feet wide. It is strongly mineralized throughout. The workings consist of a 25-foot shaft. One of the prime features of the mine is that it yields pay ore from the surface, a portion of it known as "the 12-inch galena," being almost solid galena. The yield in lead is 71 per cent., with a value in silver of $25.12 per ton.

The Baltimore mine has a ledge between walls of about 8 feet, rich in petarque, lead, and gray carbonates. Assays from specimens taken from various parts of the ledge, and at different depths, were $91, $97, $157, and $212 per ton. The developments consist of three prospect shafts, varying in depth from 7 to 10 feet, and a tunnel 80 feet long, which, when completed, is intended to strike the main ledge at a depth of about 20 feet below the bottom of the deepest shaft. In the course of the tunnel several rich streaks have been cut through. The Baltimore adjoins the Plumosa.

The Mohawk is a strong iron-capped ledge of free-milling ore, some 12 feet in thickness, with an assay of $5.01 in gold and $301.57 in silver. A streak of about 15 inches in width averages the amount given all through. Considering the rich ore and the strength of the ledge, the mine has every evidence of being one of great value.

*Cababi district* embraces a large area of the Papagueria. It has produced some very rich ore, large quantities of which were packed on mules to the reduction works in Northern Mexico before the American occupation.

The Pichaso mine was worked many years ago by Mexicans, and a great deal of high-grade ore extracted. This ore carries silver and copper, native silver occurring in considerable quantities. The mine is opened by several shafts, and is now owned by a company who are about to erect hoisting works.

The Desert mine has been explored to a depth of 70 feet and shows a strong ledge of silver and copper bearing ore.

The Cababi Consolidated Mining Company has been quietly developing a number of mines in the Cababi Mountains, about 10 or 12 miles this side of Quigotoa district. The result of developments so far is very satisfactory to the company. They have taken out United States patents for five claims belonging to their group in the Cababi Mountains, namely, the First Prize, the Grand Prize, the Petanki, the Littlefield, and the Little Monarch, and have done considerable development work on several other claims in the group. Some of the ore is free and runs up well in silver. A shipment of ore from the First Prize, Grand Prize, and Littlefield, from smelting ore, ran from 30 ounces and upwards to the ton in silver. Another shipment from the main vein on the Grand Prize gave from the furnace 42 per cent. copper. Excavations from drifts in the tunnel from the northwest shaft into the hill show some very fine silver ore. This ledge is very promising, and seems to be distinct from the main vein which runs so heavily in copper. A shipment of ore from different veins on three of these claims was run into mat, and the charge showed 77 per cent. copper to the ton, and on assay $38 in silver with a small quantity of gold.

*Helvetia district* is on the eastern slope of the Santa Ritas. It is well supplied with wood and water.

The Omega mine continues to yield plenty of ore for the smelter, which is now making regular shipments. There are 70 men employed on this property.

The Blue Jay mine, situated in the vicinity of the Columbia Copper mine, contains three different veins or branches, and three distinct classes of ore. One is a chloride, thickly interspersed with native silver, and mixed to some extent with bromide of silver. Another is a quartz, heavily sprinkled with native silver that can be seen distinctly with the naked eye. A sample of carbonate is a third class ore. It assayed from $300 to $700 a ton. All these specimens are croppings from the surface. The most wonderful feature, however, is that the surface of the mountain is thickly covered in some places with a decomposed ore that looks like black soil, and can be gathered by the ton. Numerous assays made give this an average value of $300 per ton. Hundreds of tons of this ore are in sight.

Much interest is now taken in the Santa Rita Mountains, several important sales of mining property having lately been made, and good ore-bodies developed in many places. The opening of the Sonora branch of the Atchison, Topeka and Santa Fé Railroad has had much to do with his mining revival in the Santa Ritas, giving as it does an opportunity to ship ores at a profit which could not formerly have been made.

Crittenden station, on the Sonorita, the point of shipment for the Santa Ritas and Patagonias, is a place of bustling activity.

There have been discovered near Salero, in the southeast of the Santa Rita Mountains, some promising ore-bodies, in which the veins are large, and the pay streaks well defined and of a high grade. There is some rich ores on the dump, several assays of which went from $100 to $2,000 per ton. For several years it has been supposed that there were good claims here, as many rich pieces of float had been found, but every effort to discover them had hitherto failed. Now that they have been found and opened, the ledges as they are developed exceed expectations. The completion of the railroad to Calabasas will be the means of making the Salero country a bullion producer, as there are many claims here whose owners are too poor to ship their ore any distance by the old wagon process. But with the railroad within 10 miles, and first-class reductions works at Tucson, thousands of tons of ore will be worked at a profit, which otherwise would have been untouched.

*Cañon d'Oro district.*—This district is on the west side of the Santa Catalina Mountains. The little gold mine in this camp is meeting with success. There are a number of good prospects here, which the building of the narrow-gauge railroad along the base of the Santa Catalina Mountains will bring within reach and make it possible to work many of them with profit.

I have placed the production of this county for 1883 at: Gold, $85,000; silver, $250,000; total, $335,000.

## PINAL COUNTY

has produced the finest of native silver and the largest masses of copper found in Arizona, and stands next to Cochise in the production of the precious metals. Its abundant ores contain silver, gold, lead, and copper. There is an ample supply of wood, water, and coal, and the climate is delightful.

The copper production has been greatly increased with the year, and a number of large mines, notably the Ray, have been developed.

In many of the mountain ranges former volcanic action is shown in the masses of conglomerates, lava-rock, and sandstone. Limestone, quartzite, syenite, granite, and porphyry exist everywhere, the last two containing the ore-bodies.

*Pioneer district.*—The following report of the superintendent of the Silver King mine, for the year 1883, will show the development and output:

"The surface improvements at the mine have been the completion of the ore-house and the erection therein of an engine and a Blake rock-breaker, one Sturtevant and one Boston air-blower with piping.

"An addition has been made on the east side of the engine-house for an engine which will supply power for the saw-mills, drive blasts and ventilating centrifugal blowers, furnish air-blast for the forges, and occasionally extra ventilation for the mine; also power for drilling, nut, and bolt cutting machines. An office building two stories high has also been completed, and a change house, which was greatly needed. Permanent fire apparatus have been purchased, and all the buildings are supplied with fire-plugs, hose, &c., ready for use. There are 12 Frue vanners at the mill to handle the pulp from 20 stamps, four new ones having been put in during the year. These vanners are run by a new vertical engine.

"The work in the mine has been confined to the enlarging of the sill floor of the 510 level, the extension of the sill and extraction of ore from the stopes of the 714 level, as well as enlarging the winze between the 612 and 714 levels from 4 by 4 to 14 by 14 feet. The shaft has been sunk 102 feet, and a station completed for the 816 level. Nothing has been done on the 612 level or any of the levels above the 510.

"On the 510 level the sill floor has been extended at intervals, until now its greatest length is 91 feet and greatest width 72 feet. A stope was started, but only enough ground taken out for one set of timbers. The total space excavated in this level is 37,100 cubic feet, of which 16,996 cubic feet have been taken out this year. It is almost entirely in ore, and the sill is being extended with gratifying results.

"The 714 level has been extensively exploited during the year. The sill floor has been largely extended, offering increased stoping-ground. During the year the volume of ground extracted has amounted to 410,418 cubic feet, and the total space excavated amounts to 657,769 cubic feet.

"A 6-inch well was sunk to a depth of 150 feet in the early part of the summer on the east side of the mill for the purpose of increasing the water-supply; a Thompson & Evans deep-well pump was put into it, and it now furnishes 1,000 gallons per hour. An artesian-well-boring machine has recently been purchased, with a view of sinking two additional wells.

"The close of the year finds us with a very large reserve of ore at the mill. The ore-house and the chutes in the mine are full, and a large quantity broken and ready for sorting."

The superintendent states that the receipt from the sales of concentrations during the year amounted to $592,503.53. The payment of dividends to January 1, 1884, was as follows:

| Years. | No. | Amount. |
|---|---|---|
| 1877 | 2 | $100,000 |
| 1878 | 7 | 350,000 |
| 1880 | 2 | 75,000 |
| 1881 | 12 | 300,000 |
| 1882 | 12 | 300,000 |
| 1883 | 7 | 175,000 |
| Total | 43 | 1,300,000 |

The vein formation in the Silver King mine from the surface downward measures, approximately, 115 feet long by 92 feet wide and 120 feet deep. The portions removed consisted largely of porphyry, penetrated and seamed with veinlets of quartz, crossing in every direction. These veinlets vary from the thickness of a sheet of paper to a quarter of an inch, and are generally accompanied by ore in a medial position, having quartz on each side next to the rock. The same condition may be seen at the present time in lower levels. In addition to these veinlets there are masses and bunches of ore, and apparently (at least in the upper levels) a central mass of quartz; a large and compact body, towards which the system of veinlets converged, or from which they may be said to radiate.

The richest and most important accumulations of ore are not found in the main body of the quartz-vein stone, which is not, as a rule, so profitable to work as the adjoining rock. The ore is more abundant in the small branching veins than in the mass of the quartz itself.

The chief body of the quartz-vein stone appears to have been the main channel of the mineralization, the main feeder to thousands of veinlets branching from it into the wall rock, following the clefts and penetrating the substance of the rock, depositing and diffusing native silver and the sulphides throughout the whole mass of rock for an intermediate distance on each side.

So far as explorations have extended, no district boundary line or wall to the ore has been found. The whole of the impregnated rock is blasted out and sent to the surface with but little selection or sorting.

The solid white quartz of the upper levels has not yet been fully explored. It contains rich bunches of gray copper ore, generally in a friable condition, almost in black powder, but rich in silver.

It is now found most profitable to crush and concentrate for sale to reduction works. Considerable quantities have been sent to the Castle Dome Mining and Smelting Company, at Melrose, Cal., to the Selby Works, and to the Omaha Smelting Works.

The mill of the company is at Pinal, 5 miles from the mine, and 20 stamps are kept constantly running. The amount crushed per day ranges from 50 to 57 tons; of concentrates was 78,944 tons, being 5.2 per cent. of the amount of ore stamped; the tailings, by difference, amounting to tons 1,453,056, or 94.8 per cent. These tailings contained, by assay, $4.95 per ton in value of silver, and the concentrates, by assay, contained $1,094.15 in value per ton in silver, being a total value of $86,377.01, which, deducted from the gross valuation, by assay, of $93,574.56, shows a loss of $7,197.55 in value, or 7.69 per cent.

The battery samples for the period averaged $61.08 in value.

The concentrates are dried and sacked for shipment in strong canvas sacks. The average content in lead, as determined from many shipments, is 21½ per cent., and of zinc 18 per cent. The chief value is in the native silver disseminated in the stamped mass in the form of irregularly-shaped scale-like fragments.

The production since the incorporation up to the end of 1881 (January 1, 1882) was $1,973,458.68. It was estimated by the general manager that 19,200 tons had been reduced and concentrated up to the 31st of December, 1879. The sale of ore for the same period amounted to $819,141.58.

The South Silver King Mining Company have made a rich discovery in their mine, having struck native silver, and are now sinking a new working shaft. Their old shaft is down about 275 feet, and we understand they made the strike while drifting west from it. This company has spent a great deal of time and money trying to catch the Silver King ore-body.

On the North King and the Eastland, situated north and east respectively from the Silver King, shafts have been sunk with the hope of finding the great chamber, but without success.

The Yankee Boy is situated a little north of the Silver King. This mine was unproductive a long time, on account of water in the shaft. This, however, has been gotten rid of, and in the main lode large deposits of rich ore have been found.

The Monarch of the Sea, north of the Silver King, is looking well. The double shaft is down 115 feet in good ore. It is solidly timbered all the way. A tunnel runs through the hill 275 feet, and metal is found everywhere. Hoisting works have been erected, and the company's road to Silver King rebuilt. It is reported that the ore here is of a different character from that in the Silver King.

The Frankfort adjoins the Monarch of the Sea on the west and is one mile north of Silver King. The shaft has reached a depth of 50 feet, all in ore similar to that of the Silver King, averaging $40 per ton silver. The vein is between good walls, and the pay streak 4 feet wide. The owners intend to sink the shaft 10 feet deeper, then cross-cut to determine the dimensions of the ore-chute. At latest accounts the mine was reported to have enough ore for a 10-stamp mill.

The Silverado is situated north of the Silver King, and adjoins the Monarch of the Sea and the Frankfort. The location lies north and south. forming a parallel succession of ledges, upon one of which there is an incline shaft 35 feet deep, and into water. There are about 12 tons of very fine rich ore on the dump. It is the purpose of the owners to sink deeper and cross-cut the other ledges, which they believe will come together as greater depth is attained.

The Truman King is a promising property. The shaft is down 25 feet in porphyry. The product is galena carrying silver. This mine is near the Silverado. On the Scotland explorations are made, hoping to strike the same vein as lies exposed in the Silverado.

The Surprise is the last mine on this belt, and is owned by the Hastings Consolidated Mining Company, who will thoroughly develop it before again starting the mill.

The Gem mine, adjoining the Surprise, has a 10-stamp mill. It has been opened by several shafts and tunnels, but is now idle.

There are many other claims in this section, notably the Arco and Lewis, on which a great deal of work has been done and some very rich ore has been taken out.

On the Santa Rosa work progresses favorably. The company has finished a 10-stamp mill, and they are sanguine that this will prove one of the best properties in the district. There is an abundance of ore in sight.

The Manhattan claim joins the Cash Entry on the south, and although there has been but little work done on it, it has indications of becoming a good property. The owners have great confidence in its future, and intend to push work on it immediately.

On the Delphine mine, near the Surprise, the shaft is down about 80 feet, and the ledge will soon be reached. The ground is easily worked and but little blasting is required.

The Concord adjoins the Copper-top mine. On this property a 4-foot ledge of quartz has been struck at a depth of 100 feet.

The Gotham mine is located about 4 miles east of Pinal. They are down about 30 feet on the foot wall, and have reached a 17-inch solid pay streak, which gives a very high average by assay. The foot wall is quartzite and the hanging wall limestone. The vein is 4 feet wide, with a quartz gangue, and the ore is chiefly chloride. The pay streak gradually and regularly widens as depth is attained.

In the Pioneer mine rich ore has been found in the tunnel. The mill is kept busy running on ore from the mine.

The Queen Creek smelter is about to be started again. A well was sunk on this property during the summer. The working of ores had begun last September, when the fires were put out by a cloud-burst, and the new well destroyed. This, however, is repaired, and the pump, which was 25 feet under water and which was found uninjured, is again in place. One of Dodge's granulators is ready to be put in place, and will work in connection with a Metcalf rapid concentrator.

The Windsor Consolidated Mining Company has suspended work on the mill.

On the Mountain View the shaft is down 250 feet. From the bottom is a drift 380 feet long, at the end of which is a winze about 30 feet deep. The bottom of this winze is in good ore, similar in character to what has been found above. This is one of the Windsor Company's mines.

On the Eureka work has been temporarily suspended. On the upper level there is a large body of quartz. The assays run $80, $90, and $130. The distance to the mill is about 4 miles, with a good wagon-road for a distance of 3 miles. The cost of transportation and mining is about $8 per ton. The ore is very soft, free-milling, and has heretofore been worked at from 80 to 95 per cent. The Windsor Company will soon resume work on this mine.

On the Ohio mine work is going on. This is one of the Terra Rica Company's group. They are following the foot wall in the tunnel. There is a good talc gouge and matrix in the vein, which is about 3 feet wide, and carries strong copper and silver indications.

The Amador and Norway are also being worked.

On the Continental Group, consisting of the Europe, Asia, Africa, America, Australia, Bio Bio, Renaico, and Nacooche work is progressing.

The Africa shows a large body of galena, assaying from $18 to $29 in silver.

In the Australia the winze is 50 feet deep. The vein is unbroken from the top 80 feet. In the bottom the mineral is 20 inches wide, and assays 17 per cent. copper, 44 per cent. galena, $15.37 silver per ton.

On the Nacooche work has been discontinued, but it is thought will be resumed shortly. The shaft is down 67 feet, and fine smelting ore has been obtained. The foot and hanging wall have been found.

Mr. W. H. Benton, of Pinal, furnishes a summary of the development of the leading mines of Pioneer district and of their operation and management in 1883:

| Name of mine. | Development. | Character of ore. | Ore shipped. |
|---|---|---|---|
| Odin | 2 shafts | | |
| Lucy | 1 shaft | | |
| Bold | do | | |
| Henry | do | | |
| New Racket | do | | |
| Plato | do | | |
| Eureka | 1 shaft, 1 tunnel | Bullion producer | |
| Silver Queen | 1 shaft | Concentrates | 2,000,000 pounds annually. |
| Silver King | do | | |
| Bulk | do | | |
| South King | do | | |
| Chloride King | do | | 30 tons, at $250. |

| Name of mine. | Development. | Character of ore. | Ore shipped. |
|---|---|---|---|
| Mount View | 1 shaft | Bullion producer |  |
| World Beater | do | High grade, worked in melter. |  |
| Belcher | do |  |  |
| Alice | do |  |  |
| Specie Paying | 1 tunnel, 5-stamp mill, building. |  |  |
| Silver Bell | 1 tunnel | Quartz, silver and lead bullion. |  |
| Golden Rule | 1 shaft | Gold mine |  |
| Surprise | 1 tunnel, 20-stamp mill |  |  |
| Australia | 1 tunnel |  |  |
| Web-Foot | 1 tunnel, 250-ton smelter |  |  |
| Vekol | 1,250 feet of work |  | $300,000. |
| Garfield | 1 shaft |  |  |
| Rea | do |  |  |

*Box Canyon Camp* is 6 miles southwest of Pinal. It has some fine-looking properties. The Bruiser is the principal vein. It shows a 6-foot vein of galena worth $30 per ton silver.

The Rea is a ledge of from 6 to 7 feet in width, carrying gold, silver, and lead. The shaft is not deep, but on the dump there is a larger amount of ore in proportion to the work done than from any other mine.

The Bunker Hill has a 70-foot tunnel, by which it is expected, in 20 feet, to strike the ledge at a depth of 70 feet. This prospect shows well on the top, gold, silver, and copper and a large ledge.

*Mineral Hill district.*—The Specie Paying mine, owned by a company, is the chief mine of the district. It is situated at an elevation of about 3,000 feet, about 1,000 feet above the mill-site. It is about seven years since its discovery. The descent from the mine to the mill is of excellent grade, where they are now building a wagon-road. The mine has several shafts and inclines. One of these leads down into the tunnel and forms an air-shaft. The tunnel is about 2 feet long with its face in ore, and runs through several strata of ore until at the end it displays a rich body 10 to 12 feet in width. There are about 600 tons of good ore on the dump. At Cottonwood they have water from artesian wells sufficient for a 5-stamp mill, which is now being built.

On the Alice mine the owners have made a deep open cut in the ledge at the north end of the claim and opened up a fine body of sulphuret and chloride ore of good grade, which is said to be rich.

The Lelo sends its ore to the Windsor mill for reduction.

The Lost Prize, formerly known as the Union West, has changed hands and will be developed.

On the News Letter work is being done on the main shaft, which is about 100 feet deep. A drift will be run northerly on the vein, which is porphyry and quartz. The vein is 3 feet wide at the bottom; the pay streak 1 foot wide. Samples from the latter assay $400. The ore is of the same character of chloride as that found on the Josephine ledge, and contains a considerable quantity of native silver.

A discovery has recently been made near the Josephine. While sinking an assessment shaft Mr. Alexander Wolverton is said to have struck a pay streak, some of which will assay $1,500 per ton in silver and 70 per cent. copper. The vein in which this ore occurs is over 3 feet wide, and in sinking 10 feet, ten sacks full of rich ore were taken out.

*Owl's Head district.*—The Lone Wiel mine and the By Chance mine ave been worked for the last three years by arrastra, and have produced ore in sufficient quantity and value to pay personal and mining expenses. Thirty-five assays taken from ore in the vein have produced an average of $240 per ton. The ore is free-milling, with a preponderance of horn and native silver. Several shafts, varying from 5 to 30 feet in depth, have been sunk. The company owning these mines has leased the Jessie Benton mill, which is now under full headway in their ores.

The Desert mine continues to improve as depth is attained. It shows a compact and solid pay streak fully 5 feet wide.

On the Chief mine a force of men has been at work drifting in the vein from the bottom of the incline. The drift is all in ore, as good in grade as in quantity.

*Casa Grande district.*—The Vekol is the chief mine here. The workings consist of a series of tunnel-levels running parallel with and connecting from the sides by cross-cuts, and from the tops and bottoms by winzes, thus securing perfect ventilation. There are 3,500 feet of these tunnel-levels, but not a single stop, except at one point where the vein matter was decomposed and could not support the ore, which was dislodged by its own weight and dropped down in great masses. Notwithstanding that no stoping has been done, 3,000 tons of ore have been extracted, giving an average of nearly 1 ton to every foot of the workings. In all the workings there is but 50 feet of barren ground. In the other portions the sides, roofs, and floors of the drifts, cross-cuts, and levels show ore either in continuous shoots, kidneys, or large chambers. From the lowest level, 175 feet, two winzes are sinking, and one of them appears to be penetrating a mammoth ore-body. It has been sunk to a depth of 50 feet, having an inclination of about 40 degrees to the southeast, and follows on all the way down. At the bottom a cross-cut has been made, 20 feet in an easterly direction, which passes all the way through ore. The other winze is down 50 feet and in ore, but as yet no drift has been extended from the bottom.

No timber has been placed in the mine, the vein matter being sufficiently compact to stand without support. This is due to the fact that the mine is perfectly dry—a great advantage, as timbering is a heavy expense. Another advantage the property has is that it can be worked to a depth of many hundred feet by means of tunnels and without doing any "dead work" or incurring the expense of erecting and operating hoisting machines. There are in sight and on the dump over 3,000 tons of ore, giving an average of $40 per ton, and ore in large quantities has been left standing in all the workings. Two hundred and forty tons of selected ore have been shipped and sold in San Francisco, Denver, Butte, and Benson. The owners have received for this ore an average of $350 per ton, amounting in the aggregate to $84,000.

The Christmas Gift mine has a vein 5 feet wide, 2 feet of which gave an average of $40 gold, and 3 feet an average of $476 gold per ton. It is said that 1 foot of the vein will average $1,000 per ton. If this mine holds out, as it promises, it certainly will prove one of the most remarkable of mines. It is the intention of the owners to erect a 40-ton smelter. The Christmas Gift carries, in addition to the gold ore, large quantities of galena, anglesite, and lead carbonates, averaging 45 per cent. lead. This enterprise gives a great impetus to business in and around Casa Grande, and will make it one of the most prosperous places in the Territory. A force of men is now at work grading, preparatory to laying a line of pipe from the Vekol basin to the Christmas Gift and to the Copperosity, for the purpose of conveying water to the furnace. The machinery will be delivered on the ground, and will be put up as fast as money and men can accomplish the work.

The Spondoolicks mine is a carbonate property, located near the summit of a very high and abrupt limestone mountain lying between the Vekol and the Reward. An incline has been sunk 30 feet in the vein, which dips towards the heart of the mountain at an angle of 45 degrees. The incline shows a regular pay streak all the way down. The ore runs high in both silver and lead.

The American Wonder joins the Vekol.

The Reward mine is located on a spur of the Vekol Range. This spur forms the southern boundary of the Cojeta Valley, and is low and irregular. It is limestone, and, like its neighbors, has been considerably shaken up at some remote period by natural forces. The vein upon which the Reward is located is clearly marked on the surface by an iron capping, the width of the vein, and running along the northwest side of the hill, just below the apex, in a northeasterly course. In prospecting the mine a tunnel was driven in 173 feet, through bunches of ore, calcareous matter, and fragmentary rock. At the breast of the tunnel a station has been cut out, and an incline driven down 117 feet, following the dip of the vein, which has an inclination of about 40 degrees. The incline, from the face down to a depth of 75 feet, is all in ore, and the opening is almost large enough to drive a wagon and team through it. It looks more like a mammoth cave than a shaft. At the end of this 75 feet a large "horse" comes in and cuts out the ore. But from this point a drift has been driven northeast in the vein a distance of about 70 feet, which shows ore all the way. Fifty-five feet from the face of the drift a large cañon or chamber similar to those found in the Christmas Gift was encountered. A large amount of fine ore has been stoped out of this chamber, and a large amount was also left standing on the walls. After opening the drift the work of sinking the incline through the "horse" was resumed, following a very narrow seam, which had the same dip as the vein. A depth of 30 feet was reached, when operations at the mine were stopped. Work being again resumed, it resulted in the striking of 10 feet of ore, which enhanced the value of the mine 50 per cent. The bottom of the incline is 250 feet below the croppings of the ledge, and is ventilated by a 190-foot air-shaft. A branch of the same air-shaft connects with the tunnel at the face of the incline. A short distance southwest of the tunnel-dump a vertical shaft has been sunk to a depth of 50 feet. This shaft taps the ledge and shows 16 feet of ore at the bottom. At the northeast end of the claim, about 800 feet from the tunnel, a shaft has been sunk to a depth of 40 feet in the vein, and shows a fine body of ore. There are from 700 to 1,000 tons of ore on the main dump, oxides and carbonates of copper, carrying a large per cent. of iron and silicate. The ore contains 58 ounces in silver to the ton, and 26 per cent. copper. The company is still boring for water; depth of 100 feet has been attained, and an ample supply of water for camp purposes has been reached. They are drilling in porphyry, and will continue on down till the contact between this porphyry and limestone is reached. As near as can be determined by the pitch of the formation the contact will occur at a depth of from 200 to 250 feet, where it is expected an abundance of water for milling purposes will be found.

The Jack Rabbit mine is 10 miles east of the Vekol, in one of the isolated ranges which cross this country in every direction. The vein is found in contact between lime and porphyry, and is small but exceedingly rich. The average of the shipments of ore is over 300 ounces to the ton. The deepest shaft is down 90 feet. This claim has paid its way since its discovery.

*Mineral Creek district.*—In this district, about 20 miles east of Florence, the ores are copper-bearing, and the ledges among the largest and richest in the Territory. Here is situated the famous Ray copper mine, with its neighbors, the Bilk and the Scorpion.

The mines of the Ray Company, some fifteen in number, are situated near the Gila River. There is an abundance of water, plenty of wood for the present need of the mines, while they are only about 12 miles from the Deer Creek coal fields, from which any quantity of cheap fuel can be secured as soon as the coal fields are segregated from the San Carlos Reservation, which in all probability will be done at an early day, a bill having been introduced in Congress for that purpose. The mines of the Ray Copper Company differ in some respects from any other copper in Arizona. Much of the ore is a species of decomposed quartz carrying native copper, which very much resembles the ores of the Calumet and Hecla of Michigan. It is of higher grade than the latter. The ore can be easily concentrated, and on that assays from 8 to 20 per cent., can be speedily and cheaply reduced, so that the concentrations will run from 85 to 90 per cent. and over per ton in copper. But the ores of the Ray Company are not all of this class; they have an abundance of carbonate ore in some of their mines, and it is the intention of the company to mix these ores with the concentrations and run them through the smelter. The mines of the Ray Company are fairly well developed; they have 1,839 feet of shaft tunnels and levels. The main shafts, three in number, are down, respectively, 100, 191, and 321 feet. They have 1,270 feet of drifts, which are said to be all in ore, and that none of the ore gives a less assay than 7 per cent., and runs up as high as 80 per cent.; the average of the mines is estimated at 15 per cent. per ton. A smelter is now being erected, and a concentrator with a capacity of 75 tons daily is on the road and will be put up immediately. This company will purchase all silver ore that may be offered, thus benefiting prospectors. One of the mines belonging to this group and company is the Bilk, which is an extension of the Silver King on the west. It has a shaft down 1,000 feet, and workmen are drifting from the bottom with the expectation of striking the great ore-chamber in the Silver King, with present favorable indications of rich silver ore.

The Congress and Gap mines exhibit an ore-body 820 feet wide and 1,000 long. They are prospected with 30 holes and cuts from 5 to 25 feet deep, all in ore, carrying from 5 to 40 per cent. copper and about $20 in silver. The formation is slate and limestone, with syenite and quartz.

The Star is west of the Gap, and has a working shaft 65 feet deep, and a cross-cut of 16 feet and a tunnel of 120 feet, with a cross-cut of 50 feet. There are 400 tons of ore on the dump, assaying from $10 to $100 per ton, besides some 40 tons of black sulphurites and native silver, assaying about $300 per ton.

The work done on the Keston mine consists of a tunnel on the westerly side of the hill 65 feet long, a shaft 32 feet deep, and a drift, or, more properly, another tunnel from the east side of the hill, all in ore. There is also an open cut, 14 feet wide, in ore. The assays run from 9 to 71 per cent. copper, and from $4 to $34 in silver per ton. There are about 300 tons of ore on the dumps. An immense body of copper ore is evident, and many prospect holes disclose the metal in masses. The ledge is plain for some 1,400 feet. There is a large quantity of red oxide of copper, and the large green dumps shine like landmarks.

The Elder mine is 2 miles west of Mineral Creek, at Riverside. A 20-foot shaft has been sunk, opening up a fine body of ore, carrying gold and silver. A recent assay of the ore resulted in a return of over $100 in gold and $200 in silver to the ton, and the entire pay streak filling the bottom of the shaft will average high.

*Rogers district.*—This district is gradually developing the rich promise of a year ago.

The Chloride King.—The owners of this mine have contracted to sink shaft No. 1,100 feet deeper, which will give the shaft a total depth of 130 feet. The contractors have accepted as a consideration for their work the ore taken out in sinking, a fact showing that they consider the ore very valuable. The pay streak is 14 inches wide at the bottom of the present shaft, and averages $300 per ton. It is reputed that the pay streak will widen out to 2 feet at a depth of 50 feet, as a 50-foot shaft sunk on an extension of the mine shows at the bottom that width of pay streak.

The World Beater is a mine of chloride and carbonate ores, and has a fair 5-foot vein in the tunnel and both shafts. The work consists of one 32-foot shaft, a 20-foot tunnel, and a 50-foot shaft. The ore is beautiful and rich, assaying frequently $1,300 per ton.

The Manhattan is a continuation of the same lead to the north. There are two lodes, in fact, coming together on this ground. It belongs to the company who own the World Beater.

The Silver Chief is another mine of this company. It has a shaft of 40 feet, another of 70 feet, and a tunnel connecting below of 230 feet. The ore is splendid; the assay value is said to be from $60 to $1,300 per ton. It is generally a carbonate, and there is also galena. A drift 18 feet long, which from the bottom of the shaft shows 2 feet of very rich metal, is in white quartz. The Silver Chief looks better now than it has done before.

The Johnny Crapeau belongs to the same company. It has abundance of magnetic iron.

The ores of the World Beater, Manhattan, Silver Chief, and Johnny Crapeau are sent to the new smelter recently erected by Donahue. Hutchinson & Co., the bullion from which will run from $700 to $1,000 in silver per ton and 90 per cent. in lead. They can work about 3 tons per day, yielding about $1,500 in bullion, at a cost of $40 per day.

The Goodenough, the Maybell, the Snowbird, the Brown, and the Dickens are valuable locations on this ridge, the latter having a shaft 85 feet deep, with carbonate of lead ore running 45 per cent. lead and $18 in silver. The Selma has a 15-foot shaft, ore being carbonate of lead and galena, and assaying $520 to $600 per ton silver. The Plato has about the same amount of work as the Selma, the ore being carbonate, copper, and silver, and assaying $516 per ton.

On the Robin mine assessment work has been done. The shaft is down 90 feet, from the bottom of which they have drifted 35 feet on a pay streak 2 feet wide. There are 30 tons of ore on the dump.

On the Snapp mine the owners struck 3 feet of good rock in the tunnel. The tunnel is 80 feet long, and strikes the vein about 120 feet below the surface croppings. The ore is principally carbonate, and has the appearance of high-grade ore.

The Monarch has two shafts, one 100 feet and one 45 feet deep. The ore is of the same character as that found in the other mines on this lode. Assays of the ore give $400.

The Sky Blue lies west of the Snapp, and has created much interest on account of its highly-colored blue ores.

It is proposed to work the mines of this neighborhood, which are near the river, by pumping water by steam to the ground.

*Belle Air district* is situated 15 miles east of Florence and 6 miles north of the Gila River. The formation is porphyry, and the ore is a galena and carbonate of lead carrying silver. The veins are large, and there is an abundance of water and of wood at the river.

The Silver Belle and the Columbia are the principal mines of the camp. Both claims are situated on a steep mountain, and are worked by adit levels. The discovery of a fine body of gray carbonate ore on the 420-foot level in the Silver Belle mine, on the Columbia lead, is reported lately. These properties are owned by the Pinal Consolidated Mining Company. This company has erected a water-jacket furnace of 20 tons' capacity on the Gila River 6 miles from the mines. Then the ores are run into base bullion, worth $250 in silver, which is shipped to San Francisco. The works are complete in all respects, and include fine large kilns for the burning of charcoal. Offices, boarding-houses, &c., have been erected, and quite a little village has sprung up at Butte. The company also purchases rich ore from the surrounding camps.

The Blue Bird, near Martinez Cañon, is an immense ledge ascertained to extend 150 feet in width. It adjoins the Martinez mine. The mineral vein on which work is done is 16 feet wide. There is a streak of spar and gray carbonate near the hanging wall; then a streak of waste rock; then a streak of galena and galena and carbonate; then waste rock; then carbonate and galena and some gray copper; then waste rock; then rock carrying iron and galena to the foot wall. The iron capping all carries galena. The mine lies right across the great wagon-road from Belle Air to Butte, and is most accessible. It is a very valuable property. A body of chloride of lead has recently been met in the cross-cut of the tunnel.

The Anna Belle mine, the Martinez mine, and the Guild mine are other valuable properties here.

I have estimated the production of Pinal County during the year 1883 at gold, $20,000; silver, $700,000; total, $720,000.

## YAVAPAI COUNTY.

This county is noted for the great richness of its silver deposits and for its abundance of wood and water. The ledges are regular and well defined and are generally free from surface displacement. Silver is found in its native state, chloride, sulphuret, carbonate, and indeed in every other condition in which it occurs in the Territory. The great richness of some recent discoveries in the Turkey Creek district is almost beyond belief.

Some of the richest and most productive copper mines of the Territory are situated in this county. The completion of the Atlantic and Pacific Railroad, which passes through the center of the county, has created much activity in the development and equipment of mines.

*Peck district.*—In the Peck mine a shaft has been sunk 400 feet and four levels aggregating 1,400 feet have been opened. Hoisting works, an air-compressor, and other machinery have recently been added, and a fine 10-stamp mill, with a roaster attached, has been put up near the mine, in which forty-five men are employed. Eleven tons of ore from the Occident, the property of the Peck Company, worked about $1,800 per ton in San Francisco.

The Peck belt extends north and south for several miles, and is located all the way.

The Alta is south from the Peck, and shows a foot vein of chloride ore, which has assayed from $100 to $5,000 per ton.

The Evening Star is south of the Alta. It is opened by several shafts and drifts, and shows ore similar to the latter and equally as rich.

The Fares claim is still farther south, and shows a strong vein of carbonate and chloride ore assaying high in silver.

The Asa Buffum is north of the Peck, and has produced ore that reached $1,000 per ton.

The Kautz is also a northerly extension; it is opened by a tunnel 100 feet in length.

The Alexandria and many other locations are on the Peck vein north of the original location. But little work has been done on any of them, although some rich ore has been taken out. South of the Peck, locations have been made for several miles.

The Silver Prince is on a large vein parallel to that of the Peck, and about half a mile east of that claim. The Prince has produced largely; the ore is of the same character and almost as rich as that of the Peck. The mine is opened by several drifts and shafts, and by a tunnel over 600 feet in length. The vein is a strong one, the rich ore-bodies occurring in pockets and chimneys. It is the property of a New York company.

The Black Warrior is south from the Prince, and is supposed to be on the same ledge. It is a large and well-defined vein, showing an ore-body from 2 to 3 feet wide. The ore differs from that of the Peck and the Prince, being composed of sulphurets, native and antimonial silver, and galena. The mine is in fine condition; 8 tons of good ore are taken out every day, most of which yields when roasted and milled 113 ounces of silver per ton. The Black Warrior is considered one of the best mines in the Territory. Twenty-five men are employed in the mine and 10 at the mill. The mill has 4 stamps, capable of pulverizing 5½ tons of ore every twenty-four hours. From October 1 to October 9 six bars of fine bullion were shipped. Although the mine has been running but a short time, $40,000 have already been taken out and shipped. A short time ago a shaft was sunk on the extension of the Black Warrior. When down 60 feet 20 inches of rich silver ore were encountered. The owners have let a contract to sink the shaft 100 feet deeper.

South of the Warrior are many claims which show well, among them the Doyle and the Lone Juniper. North of the Prince are the Curtin, the New York, and other locations, on some of which considerable work has been done.

*Tip Top district* is 50 miles southeast of Prescott, and about 45 miles north of Phœnix in the southern spur of the Bradshaw Range. It has been worked continuously since its discovery in 1875, and has produced more bullion than any other district in Yavapai County. It has been the best chloriding camp in the Territory. The formation is a micaceous granite, and the veins, though small, are regular and well defined. The ores are mainly chlorides, carbonates, sulphides, and sulphurets.

The Tip Top has been the principal mine of the district, and, after having produced nearly $2,000,000, has been closed down for good, as the ore is exhausted.

The Cross-cut is 4 miles west of the Tip Top, and is the largest mine in the district. The ledge crops boldly, and is traceable across the country for several miles. It is located nearly all the way, and shows some promising claims.

The Foy, one of these claims, has a 2-foot vein, assaying from $50 to

$200 per ton. The developments are a shaft 180 feet deep and several shallow cuts.

The Pearl, south of the Foy, is a large ledge of good milling ore. It has a shaft down 60 feet.

The Seventy-six is a small vein of rich chloride ore.

The Silver Museum, the El Dorado, the Camp Cole, and the Argus, resemble the Seventy-six in the character of ore.

These claims are worked profitably, and the ore shipped to reduction works outside of the Territory.

The Virginia No. 2, four miles from Tip Top, on Tula Creek, is a small but exceedingly rich vein, which has produced a great deal of ore worth over $1,000 per ton.

*Bradshaw district.*—The South Oro Belle mine is 18 miles from Tip Top. There are 7 men at work and 200 tons of ore on the dump. The gold and silver are carried in sulphurets, and average assays go $100 in gold and $50 in silver. The shaft is down 150 feet, and a tunnel, keeping on the vein, runs 200 feet into the hill. The ore is packed 18 miles on burros and 65 miles in wagons for transportation to the Argo smelter at Denver.

*Big Bug district.*—The principal mine here is the Belle. It is opened up by over 1,600 feet of shafts, drifts, and winzes. The main shaft is down to a depth of 380 feet. At 105 feet there is a north level extending 300 feet to the surface of the mountain side, and a south level 205 feet in length. At 210 feet is what is called the tunnel-level, which extends from a cañon at the foot of the north side of the mountain beyond the main shaft 127 feet. From the mouth of the tunnel to the main shaft is 450 feet, making the whole length of the tunnel-level 585 feet. At a distance about midway from the main shaft and the mouth of the 100-foot level is a winze connecting the levels, and extending to a depth of 60 feet below the tunnel or a total distance of 170 feet. One hundred feet south of the main shaft is another shaft 47 feet deep, which is being connected with the 105-foot level by an uprise from it. The ore varies from a medium high-grade of free-milling gold ore to silver-bearing galena. The average assay value of this ore is from $110 to $120 in gold. But comparatively little stoping has been done yet, and that chiefly on the 105-foot level, although two stopes have been started in the tunnel-level.

The Belle is owned by the Howell Smelting and Mining Company of Lynx Creek, and is situated about 2 miles from the smelter, on the divide between Lynx Creek and Big Bug.

Of this and other mines in this district Mr. Van Name writes as follows:

"There are but two producing mines in this district, the Belle and the Copper Mountain. The Belle has been producing 30 to 40 tons per day, and the ore is worked at Howell reduction works on Lynx Creek.

"The Howell reduction works produced from May to December, 1883, $217,694.

"The Silver Belt is shipping its ore to Pueblo, Colo. The main shaft is in 300 feet and the levels 800 feet. The mine now shows fine bodies of high-grade ore.

"The Bullion mine has been prospected, and has a shaft 80 feet deep, showing body of ore 18 inches to 5 feet wide, said to assay in gold and silver $70 per ton.

"The Hamilton is the first extension south of the Belle. It has two shafts, one 46 feet and one 70 feet, and shows ore from 2 to 4 feet, said to assay $40 to $60 per ton.

"The Poland mine is the first extension south of the Hamilton. It has a tunnel 60 feet and shaft 30 feet, showing body of galena ore from 15 inches to 3 feet, carrying gold and silver said to assay $50. They contemplate the erection of concentrating works, and hope to make a good showing the coming year from mines in this district. There are several other mines showing good bodies of ore, but of these I have no data.

"The Copper Mountain mine is opened up well. A 30-ton smelter has recently been set up and coke brought in. The smelter has run every day, running out 6 tons of copper, which is perfectly free from arsenic or antimony. The Copper Mountain and the Copper Queen mines are, so far, the only Arizona copper mines which produce the free metal."

*Walker and Lynx Creek districts.*—This is one of the oldest mining regions in Yavapai County, and Lynx Creek has been the richest gold-bearing stream in Arizona. It is now mined successfully when water can be had.

The richest of the placer mines were soon worked out, and the great cost of the necessaries of life, together with fear of the Indians, deterred most men from attempting to work on the poorer diggings. Thus population decreased, until what was once the largest mining camp in Arizona sank into insignificance.

Attempts were made at various times to work the quartz by mill and arrastra processes. Some men were very successful, but as depth was attained the sulphurets increased, and mines were not equipped with machinery for the treatment of rebellious elements. This difficulty has been overcome and the erection of the Howard Mining and Smelting Company's extension works gives new impetus to the mining industry of this district.

These properties are situated 12 miles southeast of Prescott, and are connected with that city by a good road, which is now being extended through the Black Cañon road to Phœnix, thus shortening the mail-route some 15 miles between Prescott and Phœnix, and accommodating a rich and rapidly developing mining region with daily mail and freighting facilities.

Mr. Crowell, correspondent of the Mining and Scientific Press, visited these properties early in the summer, and thus describes the results of a few months' well-planned labor:

"There stands a 30-ton water-jacket (Rankin & Brayton, San Francisco) smelter; one 80-ton Howell cylinder rotary oxidizing furnace, to prepare rebellious ores for the smelter; a Wheeler crusher, of largest capacity; a small mill for reducing ore for accurate sampling; a steam-engine of ample capacity to furnish the power for double the present plant. Convenience is secured by ingenious plannings, positions, and mechanisms, and even the most unshapely roughness of the location is used just as if it was intended and fashioned for a most perfect and labor-saving reduction-site. The steam-engine moves the automatic combinations. The rock received from the teams on the upper-terrace floor falls into the crocodile jaws of the crusher, that rapidly reduces it to the proper fineness or size, and it is thence automatically and regularly transferred to the rotary cylinder furnace, which revolves slowly as the heat passes through it. The cylinder is placed at a slight inclination, and as it revolves the ore within it is dropping from top to bottom, and slowly passing downward toward the lower and hotter end, and gradually losing its sulphur, arsenic, antimony, and various properties that interfere with the most successful smelting.

"This Howell rotary was considered the greatest achievement of American success in the great problem of working the rebellious ores of Nevada, where it was used with eminent success as a chloridizer of the precious metals, and at the same time oxidizer of the base metals, and thus preventing their being amalgamated, they were carried off with the tailings, and the dechloridized silver in the ore would then amalgamate and give from a base ore a result of fine bullion.

"This one metallurgic achievement, in comparison with all the other devices calculated to attain the same results, stands out chief and alone, if viewed in its economic, healthful, and successful records. This is one of the many silver-ore machines that we take a special pride in, its being of Pacific coast origin, and one that every progressive mining nation will sooner or later adopt.

"The smelter has been running now one month from 1st of May, has shipped crude bullion to amount of about $25,000 to Chicago by the Atlantic and Pacific Railroad, sixty miles freighting by teams to depot at Ash Fork. The freight of nearly ninety tons of bullion out, and the coke brought in, amounted to 230 tons for this first month.

"The Trinidad coke costs at furnace $36 per ton, but when the railroad now talked of, and surveyed, to Prescott, is completed (if ever), then the same coke would probably cost not over $16 per ton, and other expenses be reduced in similar proportion.

"There is a large force of men employed in shaping the foundations for future and immediate additions. Another and larger water-jacket smelter beside the present one, and a stamp mill with pans, and settlers with Frue concentrators, will be immediately erected to dispose of a class of free-milling ores rich in gold and silver to better advantage than by smelting and selling with lead bars. The concentrators will save the principal portion of the sulphurets that are more or less seamed into the free-milling ores, and then these sulphurets will be passed through the smelter. Refining and reduction works will also be put up, with cupel hearths to refine the base bullion, by converting the lead into litharge (oxide of lead), and use that as flux for the furnaces, when needed, and bar the bullion, as fine silver and gold, instead of lead, as now shipped."

Since this writing, the improvements contemplated have been completed, and now the works combine the different methods of milling, smelting, and roasting ores. These are a fine stamp mill, 30-ton smelters, three Frue concentrators, roasters, &c.

The Frue concentrators are almost perfect in their working, saving a high percentage of mineral. The Frue is regarded as an excellent appliance for the concentration of the sulphuret ores of this section, and if erected in connection with many of the idle batteries in the old districts would probably largely increase the production of the region. Thirty-six thousand pounds of bullion were shipped on November 2, making the shipments for the month previous to that date 200,000 pounds. The mill and smelter run night and day. The Belle mine, owned by this company, reported enough ore in sight to keep one smelter running for several months. Some twelve other mines bring their ores here for reduction, among which are the Happy Jack, Dosoris, Silver Belt, Kittie, and Middleton. The company pays cash for all classes of gold and silver ores delivered at the mill. They have built good wagon-roads to their mines, and three pack trains of about twenty mules and burros each make two trips daily to the Kittie, Silver Belt, Dosoris, and other mines in the district.

Mr. Henry Bigelow, of Bigelow & Co., owners of the Sumner, states that they also own ten other locations at Ross Camp, within a distance of 1½ miles of each other, on State Creek, the Peacock, on Maple Gulch, and the Arizonite, adjoining the Sumner. Of the latter he says: "The only vein of micaceous iron carrying gold and silver in paying quantities, except one in Chihuahua, Mexico. The Arizonite is on the Sumner vein, is of smaller size, but presents the same general characteristics. It has one shaft 20 and one 15 feet deep." Of the claims on State Creek he says: "On these claims are four tunnels, two of 30 feet each in length, and two of 100 feet each; also two shafts each 20 feet deep and two 30 feet deep. The veins are large, the vein matter being from 10 to 30 feet in width. Work has been done on these claims, either in one or the other wall of the vein, on strata of ore varying from 2 to 4 feet in thickness. The ores consist of quartz carrying gold and silver, with iron and copper sulphurets, also a little zinc and galena, and are considered base milling. From these claims 25 tons of selected ores have been sent to Denver and Pueblo for treatment, at a cost of $44 per ton for transportation, and $16 per ton for reduction. The average of the different lots of ore so sent was $166, after deducting return freight on sacks, &c., $100. The value of the ore is one-third gold. These mines are sending all ore taken out to concentrating works just erected, about 3 miles distant, where the ores are to be treated, 3 tons of ore being concentrated into one. The cost of transportation on mules is $5 per ton, and the cost of concentration $8 per ton. These veins are of great promise, but have only been worked since June of this year. Exceptional assays run up to $1,500 per ton. In different openings there are 2 feet of ores that give an average of $55 per ton silver and about $20 in gold."

The locations on Maple Gulch are all worked on the surface for free gold, and in different open cuts and shafts, to a depth of from 10 to 30 feet where the ores change to a base character. At a short distance below the surface, water is found in all these mines.

These claims are situated in the Sierra Prieta range of mountains at an altitude of 7,000 feet and in the midst of a heavy belt of fir pine and oak timber, 40 miles long and 5 miles wide, and they are excellent facilities for working the ores.

"*Walker district*," writes H. S. Sheldon, "is situated on the head of Lynx Creek, about 15 miles from Prescott, in a southeasterly direction at an altitude of 7,000 feet. The condition of its mining industry has not materially changed during the year, but a more hopeful feeling is entertained than in any previous year.

"Of the hundred or more locations of this district, only about fifty have been improved, other than the annual assessment work.

"The Kitty has been leased during the year. It has a tunnel of 150 feet, with a winze 40 feet, and a depth from surface of 116 feet; vein varies in width from 6 inches to 2 feet; assay value, gold, $50, and silver $14, or a total of $64 per ton. Of the ore extracted 41 tons were treated at the Howell smelter, but the result is unknown. Nine tons were concentrated at the Groom Creek mill, making 2,250 pounds of concentrates. Assay value of ore, $64 per ton. The ore extracted is principally carbonate.

"The Mifflin has a shaft 60 feet deep and prospects well in gold. A number of tons from this mine have also been at Howell's, the result of which is not known.

"The Wadleigh has turned out some gold bullion, but at present operations are suspended. About 8 tons of free ore from the Eureka have been worked by arrastra process. Total yield, $460 in gold.

"The Yi Yi, Henry Clay, Fortune, Champion, Capital, Grey Eagle, American Flag, and Real del Monte are prominent mines of the district, but little work has been done on them.

"On the Shelton a tunnel has been extended 50 feet, making a total of 190 feet. Ore is of high grade. About 450 tons of ore from this mine, American Flag, and Real del Monte, are on the different dumps.

"Three miles distant is the Senator mill, ten stamps. Two concentrators are in operation. It is situated on Hassayampa Creek, in Hassayampa district."

Dr. S. B. Farnham sends in the following report of the Lowell mill and mines:

"The Ironclad mine was located November 15, 1881. It consists of one full claim of 1,500 feet in length by 600 feet in width.

"The Memphis mine or lode adjoins the Ironclad on the south.

"Next is a mill-site, 300 feet on the north end of the Memphis mine running south from the Ironclad, 300 feet by 600 feet in width, thus making a continuous claim of 1,800 feet in length by 600 feet in width. Through this property there are four parallel veins, three of which have been worked by shafts as follows: No. 1, shaft 20 feet; No. 2, shaft 50 feet; No. 3, shaft 50 feet; No. 4, vein not yet opened. The three ledges, as far as worked, show well-defined vein matter from 3½ to 4 feet in thickness. Of this width from 12 to 18 inches is pay ore, assaying $166.10 per ton, gold and silver.

"Upon the mill-site has been erected a 5-stamp mill, with power for ten more, besides many other appliances. At present the battery is only supplied with copper plates for the amalgamation of free gold. There is a good boarding and lodging house, and about 100 cords of wood at mill and upon the grounds. The entire property is well timbered, and there is no lack of water, the supply being furnished by means of a shaft sunk to the depth of 20 feet, on the lower side of the mill, by the side of a deep ravine; from the bottom of the shaft a tunnel passes across said ravine 21 feet in length, yielding a large supply; while at the upper side of the mill, a few feet from the ore-house, in shaft No. 1, at a depth of 20 feet water was encountered to such an extent that it now stands within 3 feet of the top. From this shaft a 2-inch pipe passes down the side of the ravine to the lower well, acting as a siphon, should more water be needed. No. 2 vein or shaft shows a westerly dip and No. 3 vein an easterly dip, being conclusive evidence of independent ore-bodies. Above the mill in said ravine or cañon are living springs of water, which have never been known to fail even in the dryest seasons.

"The work performed on the Golconda consists of a cut into the mountain about 750 feet south from the Wadleigh line, crossing the vein, and a shaft started, showing 4 feet of ore, carrying free gold visible to the naked eye. At the south line of said vein, where a deep cañon cuts the formation, the ore-body has been exposed, and presents a fine opening to run a tunnel north, starting in good pay ore. The outcrop of this immense vein is traceable for several miles and several valuable locations are taken up on the north from the Wadleigh, the first one being the Mifflin, which has a 60-foot shaft, all in ore. Further on are the U. S. M., Sililo, Lowell, Silver Spur, and Pajaro, all of which have more or less work of development done, showing a continuous vein for that distance.

"A good wagon-road connecting with the Lynx Creek road to Prescott, distant 15 miles, is already constructed. One and one-half miles below the mill is a saw-mill, while two miles from the mill are the

Howell smelting and reduction works. The present openings on the Ironclad mines are so convenient to the mill that the ore raised can be landed into the mill by means of cars and track, therefore no hauling or second handling will be required. The entire property is heavily timbered with pine, oak, and juniper, therefore the material for fuel and mine timbering is of but trifling expense. The ores from these properties being of a rusty gold, carrying sulphuret, requires the addition of some process for concentrating to the present plant to warrant a perfect success of the mill workings.

"Assays on Wadleigh samples, taken the full width of cross-cut, 21 feet from wall to wall, was $5.65 per ton. Samples from wall to wall of the 13-foot cross-cut was $16 per ton; from pay streak, 2½ feet wide, was $258.69 per ton, showing an average of $93.44 per ton in gold and silver.

"Assay on the Ironclad: Two samples across full width of vein matter run $23.55, $47.55. Pay streak, 9 inches wide, $236.79, making an average of $102.63 per ton, gold and silver."

Mr. George W. Curtis, of Prescott, reports as follows:

"The Gold Block mine has been opened by one shaft 30 feet down, and another 70 feet down. These developments show a continuous vein 4 feet wide, with an average assay value of $100 in gold, and a few dollars in silver to the ton of ore, mostly free milling.

"The Kimball has one shaft down 130 feet. At 100 feet from the surface levels 80 feet in length have been run. These developments show a vein of from 3 to 4 feet wide. Three hundred tons of ore, taken from the shaft and level, are on the dump, not a pound of which will assay less than $100 per ton; all free-milling ore. Two thousand two hundred dollars were extracted by arrastra from ore taken from the shaft at a depth of 65 feet.

"It is intended to erect a 10-stamp mill on these properties inside of two months. Some placer ground near these mines will be worked as soon as there is sufficient water."

From other and later sources we learn that the Gold Block is yielding rock which is worth $1,000 per ton. A shaft has been sunk 15 feet below the 100-foot level, and the ledge therein is larger than before.

Close to the Ironclad is the Fortuno. Specimens from this mine show considerable sulphurets in the galena. The ore would be good for smelting.

There are several other good ledges in the neighborhood of the Lowell mill.

Placer mining has been carried on here to a considerable extent when the melted snow or the rain produces sufficient water. The Capitol mine is being worked.

*Turkey Creek district.*—This district, which has lately been brought into prominence by the discovery of wonderful deposits of almost pure silver, is situated on the eastern slope and foot-hills of the Sierra Prieta range. The camp has a bountiful supply of wood and water, and the climate is unsurpassed in the territory. The formation is granite, porphyry, and slate. The district is 20 miles southeast of Prescott.

The Pine Spring mine, whose recent discovery has created such a stir all over the territory, is one of those mineral marvels which are peculiar to Arizona. From a small shaft not more than 20 feet deep, $50,000 has been taken. Such masses of horn-silver were never before found in the Territory. Chunks weighing 60 pounds, and worth $14 a pound, have been taken out, and the ore assays as high as $26,000 per ton. The vein, as exposed in the shaft, shows in places 2 feet of chloride that will go $5,000 per ton. The mine was discovered by an old pioneer named Billy Gavin. There are no indications on the surface, and the discovery was made by tracing the dark metallic pieces of float found on the hillside some distance below. The shaft is now down 125 feet. There are two tunnels, one 42 and the other 30 feet. Water in small quantities is coming in. There is a great deal of very rich ore in sight in shaft and tunnels, and they are now drifting south on the 72-foot level in a large and well-defined body of native silver ore. This mine is in a hill which appears to be a common center for leads to unite. The country for miles in any direction is permeated with ledges of high-grade ore.

The Cash Entry is located on the third extension north of the Pine Spring mine, and on the same ledge. There is a shaft down 50 feet, showing good ore all the way, and the greater the depth the richer the ore. The ledge is well defined, and about 5 feet wide between the walls. They have 6 tons of ore on the dump that will average about $400 to the ton, and a large quantity of low-grade ore which they are making preparations to work.

The Syndicate lies to the south of the Manhattan and to the north of the Pine Spring mine. The shaft is down to a depth of about 50 feet, and shows up a large body of high-grade ore that will average very well. The owners are pushing work, and expect to strike a large body of high-grade ore as soon as they get into the mountain.

The Turkey Creek Mining Company's plant is owned by Chicago and Wisconsin capital. It consists of a 30-ton water-jacket furnace and a fire-hearth reverberatory furnace. This company has also a saw-mill attachment running out the lumber needed. Several mines belonging to the company are now being developed by a small force of men.

The Gold Note has the most work done on it. One shaft is down 270 feet and is 40 feet below the water-level, with a ledge running from 1 foot to 4½ feet in width. It is mostly galena ore, containing silver, lead, and iron, the average assays being $75. One thousand four hundred tons of ore are on the dumps, and this was taken out while running levels and shafts, no stoping having been done on the mine yet. About 700 feet of levels have been run.

The Bullion has a 105-foot shaft and 50 feet of drifts, with a ledge about 3 feet wide; assays $75.

The Crown Point and four other new mines have had assessment work done on them. From all appearances this camp will soon be turning out its share of base bullion.

The Goodwin is one of the mines belonging to the Nonsuch Mining Company of Philadelphia, and is reached from the Turkey Creek Company's works by a trail over a high dividing ridge. This is a Pennsylvania corporation, with headquarters in Philadelphia. The property of the company consists of 2,400 linear feet on the famous Goodwin lode, about 3 miles from the town of Goodwin. The property has upon it openings aggregating considerably over 700 feet. The principal development consists of a main working shaft of slight incline, 187 feet in depth, which is connected by level with another shaft 125 feet deep, while some distance south from the latter is another shaft 120 feet deep. This mine not only bears evidence of greater development than any other property in the district, but can also boast of greater bullion shipment. The present owners have had possession but a little over a year, during which time they have systematically opened the mine without drawing upon ore reserves. They are now commencing to take out ore and will soon make their first shipment. The ore is largely black sulphurets with argentiferous galena, considerable native silver, and more or less ruby silver. The outlook of this property as a permanent bullion producer is very favorable. Operations are conducted upon a strictly conservative basis. The entire capital stock is subscribed, paid in, and owned by less than a dozen persons, who conduct the affairs as a close corporation. They have the improved iron drum whim with wire cable and safety breaks, which seem in every way very efficient and safe for the present requirement.

From Mr. B. W. Crowall is learned the following of the Arizona Consolidated Mill and Mining Company:

"This company, organized under New York laws, have a complete quartz mill and roaster capable of treating 15 to 20 tons of ore per day. The plant is immediately on Turkey Creek and about 22 miles southeast of Prescott, on the regularly traveled stage road. The mill-site adjoins the town of Goodwin. The mill, having undergone many changes and modifications that were found necessary subsequent to its first completion, is now believed to be in good running order. It is not a stamp mill. The process is at once simple and apparently effective.

"The ore is delivered upon a platform of equal level with the upper story of the mill building. In this room is a rock-crusher, now a 'Little Giant,' the company being about to commence the erection of a 'Blake's Challenge' to secure additional capacity.

"Having by means of these crushers been reduced to particles the size of a walnut, the ore is conveyed to the 'pulverizer,' which, in the present mill, acts in the place of the ordinary stamps; this apparatus being upon a lower floor, the process becomes continuous. The ore falls into a hopper, by which means it is fed into a cylindrical vessel about 24 inches in diameter; in this two arms make 3,000 revolutions per minute, and, coming in contact therewith, the ore, or a very large percentage of it, is reduced to an impalpable powder, and passes out the circumference of the cylinder through small holes in the lining. The pulp is then caught by an elevator and taken to the screens—first a forty, then a sixty mesh.

"*Process of amalgamation.*—Such portions as pass the latter are ready for amalgamation, for which portion of the reduction this mill employs two processes. The first, known as the 'Forster-Firmin,' embodies a principle meriting description. Against a stream of the fine pulp is projected a column of quicksilver, by strong steam pressure, almost sufficient to vaporize the mercury. The force of the steam in itself compels amalgamation, but, to render the operation more complete, the mass is projected with this great power into a large iron chamber. From this the amalgam falls to a large washer on a floor beneath. In this washer are two heavy iron mullers which further facilitate progress of the operation. At the proper time a chamber attached to the pan—the bottom of which is conical—receives the amalgam, while the watery mass remaining in the washer is drawn into residuary pans and the result worked very closely. The steam power for this mill is furnished by a superior 45-horse-power horizontal engine, which, we are assured, affords superabundance of power. The machinery appears to have received much attention in every detail, and bears evidence of large expenditure. A trial run of 20 tons free-gold ore showed but a trace remaining in the tailings, the assay value of the ore being $56 per ton, which would appear to be a conclusive proof of the efficiency of the mill.

"The principal mine owned by the company is the 'Morning Glory,' distant from the mill about 3 miles. It is rich in free gold above water-level, and the sulphurets below water-level can be worked to profit when reduction works are perfected in the vicinity or transportation for the ore secured.

"Abundance of water and timber constitute two great advantages of this camp, which, in view of the recently uncovered bonanzas, is likely to assume considerable prominence among the bullion-producing camps of the country."

The Holmes mine is opened by a tunnel 200 feet in length, and by a shaft 85 foot deep. The ledge will average 3 feet wide. The ore is a rich gray copper, with antimonial silver, and is worth from $50 to $1,800 per ton.

The Hatz and Collier claim is north of the Holmes. It is owned by a Chicago company, who have a force of men at work opening it. The vein is from 2 to 3 feet wide, the ore being of the same character as that in the Holmes. There is a shaft down 200 feet and a tunnel 250 feet.

On Lower Turkey Creek is the Franklin. The tunnel is in 202 feet; the ore is said to be good, an iron sulphuret, carrying lead and silver; width of vein from 1 to 2 feet. Openings are being made above and below the level of the tunnel.

On the Quick Relief they have erected hoisting works, and have a shaft down 150 feet. The vein is small, but carries some good ore.

The Yankee Boy has a shaft down 30 feet in good ore, principally chloride. It is free-milling, and is being taken out as fast as the force employed will allow. A streak of ore has been met which assays $2,000 to the ton.

The Peerless Mining Company has struck a large body of high-grade ore at a depth of 106 feet. The ore is found to assay $657 per ton. Thus far no correct statement can be made of the amount of ore in the mine as the cross-cut has not yet penetrated the hanging wall, but the indications are that there is a large body of ore.

The Wheel of Fortune is a promising claim; also the Union.

It appears from all experiments made on Turkey Creek that the great ore-bodies of the district are not found until a depth of from 200 to 300 feet is attained. Surface workings show that the ore is scattered all through the veins, but when the proper depth is attained the ore becomes concentrated in solid bodies of a richness which justifies the outlay necessary in sinking.

In Blind Indian Cañon they are taking out very rich chloride ores.

A mine has been discovered in *Pine Flat*, which is said to be as rich as the Pine Spring mine. The vein, which is large and well defined, is rich in chloride and carbonate. Chunks of horn-silver, similar to that of the Pine Spring mine, are being taken out of the new bonanza.

*Hassayampi district.*—In Ross Camp, a part of this district, lies the Sumner. This location has been developed by an open cut. run through hard slate for 40 feet. It shows a very strong lead of silver-bearing ore in conjunction with slices or kidneys of mineral, resembling iron carburet, being in fact a micaceous iron. It is free from grit, very bright, and so soft as to rub fine between the thumb and finger. The prospects here were so good that the owners that were encourged to go below and tunnel in to strike the vein. They encountered hard slate country rock, showing glittering iron sulphurets, the cost of tunneling amounting to about $12 per foot. They found similar indications below as above. The vein is 30 feet or more across, and some portions give high assays of silver.

Two miles north on the ridge lies a group of mines of which the Davis is the largest. The southern or lower end of the Davis or Broadway is well prospected by a tunnel 200 feet long. The average assay of the ledge is given at $150; the ledge is 5 feet thick. Considerable work has been done on the vein, and wherever opened it shows remarkably well.

The Pearl, North Davis, and Dunkirk, all strong, well-defined veins, are opening up with good ore. Assays from the dark blue streak of the vein gave over $800 per ton; $477 gold, balance silver. This streak is from 4 to 6 inches thick. An adjoining vein assays $282; $162 being gold, balance silver. The stratum here is about 12 inches thick. The iron streak on the west hanging wall, 4 to 6 inches, gave $35 in gold, and some little silver.

Near the above lode lies the Esmeralda, with piles of ore clean and free from cab rock. Many of these ores consist of azurites, with chlorides, some of which have assayed over $1,000 per ton.

The Dosoris is yielding fine ore. Forty tons smelted at Howell's reduction works yielded $815 per ton; 20 tons sent east, over $1,800 per ton. Another lot of 25 tons will probably average $800 per ton. This mine has a vein of about 5 feet, yields chloride, black sulphurets, native silver, and very rich streaks of galena. The shaft is now down over 420 feet, where the ore averages from $1,000 to $1,500 per ton.

On the Ruby work has been resumed. Two tunnels have been driven on the vein. One is over 200 feet, and the other 160 feet. The vein is strong and continuous all the way, and this discovery promises to become very valuable.

The Dunkirk is east of the Ruby. It is opened by two shafts and a short tunnel, and shows a ledge 2 feet wide. As depth is reached the ore promises to be of the same character as that in the Ruby.

Messrs. McDonald and Davis have leased the Blue Dick mine and have struck a good-sized ledge of high-grade ore. This mine is opened by two tunnels.

The Mark Twain, south of the Blue Dick, is an encouraging prospect.

At the Senator mill preparations are making to work concentrators in connection with the stamps. The mill has 10 stamps and plenty of room; but at present only 5 stamps will be run with 2 Frue concentrators. Quantities of ore from mines near by are on hand. There are fifty mining claims within 5 or 6 miles of the mill, carrying gold and silver in connection with baser metals, and ranging in assay value from $25 to $75 per ton, which can be concentrated with one-fifth or one-tenth of their bulk when the product will bear shipment to reduction works at Pueblo.

The U P mine is looking well. In the bottom of the shaft, at a depth of 48 feet, they have lately developed a large body of ore.

The Grape Vine claim is developing into an excellent property. The ledge is 2 feet wide, and averages high in gold and silver.

Mr. David Grubb gives us the following description of the mines in this district:

"The Snow Clad is in the southeastern part of the district, about 10½ miles of Prescott and within a half mile of the Prescott and Bradshaw road. The property is developed by an open cut and prospect holes. Out of the cut, 17 feet long by 9 deep, 24 tons of ore have been taken; 1¼ tons of first-class galena, assaying $91.10 in silver, and about 50 per cent. lead; 17 tons second class, which would assay, probably, $40 to $50 per ton, 15 per cent. lead, and 6 tons third-class ore, assaying about $20 per ton, with a small amount of lead. One hundred feet south of the open cut the ore is 6 feet wide. Shallow prospect holes show 3½ feet of carbonates, assaying $37.77 per ton, probably 20 per cent. lead. The remaining 2½ feet carry more quartz, and assay $20 per ton, with about

10 per cent. of lead. Southeast of this vein is another 3 to 8 feet wide, carrying carbonates and oxides. This open cut and the prospect holes are about 600 feet from the southwest end of the claim.

"Two hundred feet from the southwest end of the claim, on the southeast side of the porphyry dike, the ore is from 4 to 6 feet wide, carrying carbonates. There is also a vein on the northwest side of the dike, from 6 inches to 3 feet wide, carrying gold from a trace to $20 per ton, with some silver and lead carbonates. Between these two quartz veins there are streaks of ore passing from one vein to the other. This claim is at an altitude of from 6,000 to 7,000 feet. It is covered with pine and other timber, and is 1,500 feet long by 125 feet on the southeast end, and 150 feet on the northwest end.

"The Cash mine is developed by 2 shafts 30 feet deep, several prospect holes, and open cuts. The vein is about 9 feet in width, mostly in low-grade ore. There are, however, streaks in this ore body varying from 6 inches to 2 feet in width, which assay $10 to $40 in gold, and from $7 to $32 in silver.

"The Pine Tree mine has a vein 3½ feet wide, which assays $20 in gold and $250 in silver per ton. This property is but little developed."

On the Howard two shafts are down, one 60 feet, the other 50. It is a showy-looking ledge, and carries its width all the way down the shafts, averaging at least 3 feet. Another shaft is being opened. As at present there is no machinery on the mine to pump out the water, a greater depth cannot be attained without much expense. Fully 100 tons of ore are on the dump. It is chiefly galena, carrying silver, average assays being over $70, with 40 per cent. of lead. The latter is sufficient to pay the working of the ore.

The mining claims of Mr. William C. Flint are beautifully located, at a height of over 7,000 feet above the sea level, in the midst of heavy pine forests and abundant water.

The Delaware mine is on the top of a high ridge, lying northeast and southwest. It is a large, well-defined ledge, 6 feet wide, with ore vein of about 2 feet rock, rusty, decomposed quartz, carrying gold, silver, lead, and copper, which will work $25 to $35 per ton. The vein has a regular course and dips about 80 degrees, being nearly perpendicular. On this vein cuts and shafts have been made at various points to prove the continuity of the ore. One shaft is 50 feet deep. At the extreme southwest end of the location an open cut shows ore estimated at $50. One hundred feet from this cut is a 15-foot shaft, the ledge growing to a thickness of 5½ feet at the bottom of the shaft.

The Grosvenor, another of Mr. Flint's mines, is located near by. The shaft is 500 feet from the south monument, and is 30 feet deep, all in ledge matter, from the croppings not less than 12 feet thick from wall to wall. This rock, a rusty, porous quartz, prospects well by the pan, but none of it has been milled. Passing north by some small shafts and cuts, the main shaft is reached. It is 50 feet deep, with a 50-foot level run south from the bottom. In this shaft the vein is found to be about 3 feet thick, giving evidence of a good mine. This lode is 7,666 feet above the sea level, and these are supposed to be the highest mines worked in the Territory.

About 200 feet below is the Fremont mine, with three shafts, 20 feet, 25 feet, and 40 feet deep, and three tunnels 12, 25, and 35 feet in length, all in vein matter, with ore traceable for 1,500 feet. Below the Grosvenor and Fremont joint tunnel is a good site for reduction works, with wood enough to last many years.

This is one of many claims of varied character scattered through this belt, easily reached by rail, the Arizona and Pacific Railroad running 60 miles north and the Southern Pacific 145 miles to the south. These mines were not earlier developed as prior to the advent of the railroad long stretches of sandy desert were crossed in reaching them.

In Crook Cañon the Crook mine, which has produced considerable bullion, has a small prospect mill a few miles distant, on the east branch of the Hassayampa, now idle. This mine has been relocated and a rich find of gold rock is reported. One ton and a half of this rock, taken from the bottom of the 75-foot shaft, yielded by arrastra process the sum of $175.

The Consolidated Bodie mines, incorporated by a New York company, lie on Crook Cañon, about twenty miles below Spencer's station. They have heavy smelting silver galena ores, and from 400 to 500 tons on the dumps. The ledge matter is from four to twelve feet thick. The shafts are 80 and 100 feet deep; a tunnel is 480 feet in on the lead. Lime and iron ore for flux are convenient, and it is expected that reduction works will be erected soon. It is reported that forty-one assays, made to test the value of the ledge where it is 12 feet thick, gave $61 in silver and 40 per cent. in lead. Good smelting works at this point will be of great advantage to the mines that lie for 7 or 8 miles above, on Crook Cañon, which formerly "arrastraed" the free croppings, but now need a smelter for their changed ores.

The Wallace has a fine showing of silver ore for the small amount of development made. The best assays ran over $400 per ton.

The Duncle mine, near the Wallace, promises well as far as it is developed.

The Belcher, formerly known as the Satisfaction, lies above the Crook mine. This mine was owned by the Yavapai Consolidated Mining Company, but when at a depth of 15 feet, the character of the rock changed, running into galena and sulphurets, the mine was closed, as the company's mill had not the appliances to work these ores. The Belcher, with the Mammoth and other mines, is now owned by Messrs. W. W. Davis & C. D. Brown, and under the new management is likely to prove very profitable. A shaft is down 30 feet and is still sinking, and a cut is run along the brow of the hill. The ledge is 4 feet wide on the top, and at the bottom of the shaft it widens out to 7 feet. The galena ore taken out of this shaft carries a percentage of carbonate of lead which is visible to the naked eye, and from an assay shows $47 in gold and $30 in silver. A tunnel can be run in on the ledge at a depth of over 500 feet from the present shaft. The mine is easy of access.

The Perkins lode, about 1 mile from the Belcher, shows the same character of ore, and is upon the same lead.

*Black Hills district* is 25 miles east of Prescott, on the eastern slope of the mountains. It is well supplied with wood and water. The geological features of the range from which the district takes its name are eruptive rocks on the north end, limestones, metamorphic slates, syenite, and quartzite in the center, and granites and porphyry on the southern end. A rich copper belt is in the district over 3 miles wide and 1 mile long.

The United Verde Copper Company, incorporated under the laws of New York, is now prosecuting operations on an extensive scale. They have built a road through the range which taps the farms on the upper Verde, whence supplies can be drawn. By this new route the distance to the railroad at Ash Fork is reduced to 40 miles, and freight on bullion and coke greatly lessened. The company owns the following mines:

The Eureka, Wade Hampton, Hermit, Chromo North and Chromo South, South Azure and North Azure, and South Venture.

The Eureka has an immense mass of copper ore, at one point over 100 feet wide. A tunnel has been run on the ledge 274 feet, which taps it 190 feet below the surface. The ore-body can be traced for over 500 feet, and at no point does it appear to be less than 25 feet wide. The ore on the surface is a green carbonate and a red oxide, and at the end of the tunnel an oxide carrying large quantities of iron. The entire body will average 20 per cent. and considerable silver. Some 700 tons have been taken from the tunnel. The matrix of the ore is iron, and the country rock that encases it, metamorphic slate. The ore is self-fluxing, carrying all the lime and iron required.

The Wade Hampton has a shaft down 67 feet, which exposes a body of ore 16 feet wide. Careful tests have shown that this will go 15 per cent. in copper. The ore is as easily reduced as that of the Eureka, and the mine promises to become equally valuable.

The Hermit is a quarter of a mile east of the Eureka. A tunnel has been driven which struck the vein at a distance of 71 feet. A winze was then sunk on the ore-body to a depth of 80 feet. The vein is regular and will average 4 feet in width.

The Venture is situated about 2 miles southeast from the Eureka. It is a well-defined and compact vein. The ore body will average 3 feet, and is very rich in metal, yielding as high as 35 per cent. There is a shaft down 100 feet. The mine promises to become valuable.

The Chromo South and Chromo North adjoin the Eureka on the east. The ores are a carbonate and a silicate, and the veins are from 2 to 4 feet wide.

The Azure North and the Azure South are encouraging prospects.

Near the Eureka the company have erected a water-jacket furnace, which is now in successful operation. The ores from the Eureka and the Hampton are brought to the smelter on cars propelled by hand. The works are erected just below the road and a tramway leads from the floor of the furnace to the rich croppings on the Eureka which are used to flux leaner ores. The furnace is supplied with a Blake crusher, and is very complete, with a capacity of 40 tons daily. With the exception of a little limestone, nothing but ore and coke goes into the feed hole. The slag runs like water, and the metal, of which from 6 to 8 tons are produced daily, contains 97 per cent. of copper, and from 300 to 600 ounces of silver to the ton. The profit on such a day's run is from $1,000 to $2,000.

The management began smelting some time in last August, and by January 1, 1884, had smelted 5,000 tons of ore, made 1,000 tons of copper bullion and copper cake, worth in the neighborhood of $300,000. This with the silver shipped from the mill will make an extraordinary showing for the first four months of operations.

*Groom Creek district* is 6 miles south of Prescott, has a great many ledges carrying gold and silver in paying quantities, and is easy of access.

The mines of the Arizona Queen Company are the Chicago, Illinois, Bloomington, and Ironclad, in what may be called the Chicago Group. The Chicago is the only mine thus far worked. The rest are good prospects but as yet are undeveloped, as the Chicago furnished all the ore the machinery could work. The mill, which is about 7 miles south of Prescott, is erected directly over the shaft of the Chicago. The building is well situated, and is 40 by 60 feet in size, with an addition of 20 by 30 feet. It contains a Beckett & McDowell steam hoist, the power for which is supplied by a vertical engine of 20 horse-power, which at the same time runs the pump that clears the mine of water. This water when brought to the surface is amply sufficient to run the mill. On the opposite side of the shaft is a 10-stamp mill complete, with a Frue concentrator, the power for running this being supplied by one of Frazer & Chalmers's horizontal engines of 15 horse-power, Corliss patent.

The Chicago mine, like many other mines in the country south of Prescott, was worked originally for gold ore exclusively, the percentage of silver in the surface workings being comparatively small. While about the same value of gold per ton is now found in the lower workings, the quantity of silver has greatly increased. The theory generally held by miners here, that surface gold quartz leads, with depth, to richer silver-bearing ores, is sustained by the developments made in the Chicago property. In the main shaft, at a distance of 70 feet below the bed-rock, a drift has been run south, in which a body of fine silver ore has been encountered. Selected assays from this ore have gone as high as $12,000 per ton. About 33 per cent. of the assay value of the ore is gold. The pay-chute is distinct from that on which exploration was begun, lies parallel to it, and is 3 feet wide.

The One Hundred and Ten mine has been leased by the manager of the Arizona Queen Company's properties. It is about a mile and a half southwest of the Chicago. This mine has been worked by arrastras for the past six years. In the old workings the pay ore has a uniform width of 4 or 5 feet, and a general average taken from the shafts a few months ago indicates the ore to be worth $90 per ton in gold, selected portions of the vein running as high as $1,600 gold per ton. Seventy-five feet has been sunk on the mine since its new management, and drifting will be begun, and hoisting works erected. At the present depth the vein is 5½ feet wide, and assays $201 per ton.

The King Kelley mine is being developed.

In the Omaha is a shaft down 60 feet showing ore. The ore on top is free milling. Galena and sulphurets appear in the ore last taken out.

The Adeel mine, in this vicinity, has had some work done on it, and some very rich gold rock has been taken out.

The Benjamin has a shaft down 50 feet, with a very fine showing.

The Admiral has some good ore, some of which was worked with good results at the Arizona Queen mill.

Free-milling gold quartz, carrying a large amount of gold, has recently been found by Mr. A. J. Rupert on his claim on Groom Creek. The first discovery is called the Flora. The Lincoln is an extension of the Flora.

Besides these is the Golden Chariot, near by, a gold mine with a vein not quite so wide as the Flora, but carrying very rich ore.

*Cherry Creek district.*—The Conger Mining Company own four or five claims on the Verde slope of the mountain, which are now being developed. On the Conger a shaft has been sunk, and some rich quartz has been encountered. The vein is from 12 to 18 inches wide. On the Cactus a tunnel has been driven 100 feet, showing a vein with 2 feet of fine ore. The company has hoisting works on the ground and a mill on the Verde River, 5 miles distant, driven by water-power, the first water-power quartz mill erected in this county. The ledges are well defined, and the ore is easily worked. It is the intention of the company to work the ore to a very high concentration for shipment east.

The Gold Ring has been explored to a depth of 100 feet. A mill test of 100 tons yielded $100 per ton. Other claims in this vicinity are the St. Nicholas, Gold Queen, Joe Johnston, and Potomac.

*Silver Mountain district.*—The once immense Agua Fria district is now divided into five or six districts, embracing Tiger, Pine Grove, Silver Mountain, Lane, Humbug, Castle Creek, and some others. Silver Mountain district takes in a large spur of the Bradshaw Mountain Range. Its edges are very large.

The Mammoth mine, one of these ledges, is the largest in Arizona. It is larger than the Vulture ledge, but is not very rich in gold. It is 55 miles southwest of Prescott. The vast magnitude and richness of the ledge have been known for years, but little except assessment work has been done on it. The locators have recently organized the Mammoth Silver Mining Company, who have had the management since last March. The bullion production has averaged $10,000 per month. The exact length of the ledge has never been ascertained, though it has been traced for a number of miles, and its width in many places is hundreds of feet. From the 220-foot level a winze is being sunk which tapped a large ore-body contained in a cross-ledge. It has been traced from the surface, but only lately has developed into a large body, promising to equal, if not to surpass, the main ledge running north and south. The ore is of a higher grade than any previously encountered in this mine. The quartz is close grained, of beautiful colors, and rich in metal.

*Tiger district.*—On the Tiger mine a force of men is at work. The shaft is down 70 feet, and at the bottom of it the pay streak is 3½ feet wide and solid ore all the way across. The assay value of this ore is $55 in silver and 85 per cent. copper. At the top of the shaft the pay streak was only a few inches wide, but it widened from the surface down.

In the West Oro Bonita, sulphuret ore assaying $942 per ton has been found.

The Oro Belle mine is getting ready to arrastra gold rock, some of which is worth $1 a pound.

Lane's Silver mine, between the Tige and the Tip-Top, is large and rich. It is tunneled in a distance of 300 feet.

The Grey Eagle, Oro Bonita, Riggs, Hammond, Eclipse, Cougar, Benton, and California are in this district.

In what is known as *The Basin*, north of Tiger district, are many fine prospects, surrounded by an extensive belt of timber.

The Buckeye is a small vein which has produced some rich gold and silver ore.

The Union, formerly the Kansas, is south of the Buckeye. It has been explored by a tunnel 175 feet in length, and by a shaft 70 feet deep.

The Esperanza is a 2-foot vein of sulphuret ore carrying gold and silver. A 10-stamp mill erected on this property some years ago failed to save the gold in the sulphurets. It is now worked successfully by Mexicans, who grind the ore in arrastras, and then smelt it in a rude furnace. It is said that the ore yields as high as $400 by this process.

North of the Basin, in what was formerly known as Pine Grove district, there are some fine properties, on many of which a large amount of work has been done. Among them are the War Eagle, which has been developed by several shafts, the Del Pascoe, Bradshaw Basin Rock, Red Rover, and many others.

*Walnut Grove district.*—Messrs. Siedman & Johnson have recently discovered a ledge here which prospects well in gold. It is about 2 miles east of Callen's camp at the Placeritas. They are sinking a shaft.

A 10-stamp mill has lately been put up to work the ore from the Josephine mine, and a ditch constructed to bring the waters of the

Hassayampa to the rich deposits of Placerito Creek. The ledges of the district are gold-bearing, and have produced some high-grade ore.

The Callen mill on Arrastra Creek is now running.

In *Weaver district* the owners of the Marcus gold mine have driven their shaft 180 feet, 75 feet of which have been put down since the first of last June. The ore of the Marcus is a very rich sulphuret. Many tons of it have been shipped East. The ledge averages 3 feet in width; water is increasing in the mine. In the Sunset mine rich horn-silver has been struck.

*Ton to Basin.*—The Excursion Company, a New York corporation, own the Excursion mill and a group of mines in the Mazatzal Mountains, viz, the Excursion, the Sumner, the Gowan, the American, and the Dollar.

On the Excursion the company is running the 110-foot level as fast as possible, and taking out excellent ore.

Upon the Gowan a whim has been erected, and the lower level—130 feet—is being pushed toward the north with all possible speed.

The Zulu is opened by shaft to a depth of 75 feet, at the bottom of which is a 9-foot vein of quartz carrying $75 per ton in gold. Two hundred tons of such ore are on the dump. The ore is free milling. Men will be kept sinking on the lode, and as the ore-body constantly enlarges with depth, it is supposed that it will reach 15 or 20 feet in width.

*Castle Creek district.*—A smelter has been erected in this district, 40 miles north of Prescott, which has given great encouragement to mining.

The Prescott Courier publishes as its estimate for Yavapai County the following:

ORES AND BULLION.

| | |
|---|---|
| United Verde | $300,000 |
| Howell Company | 400,000 |
| Black Warrior | 100,000 |
| Silver Belt | 200,000 |
| Tiptop and neighboring mines | 75,000 |
| Dosoris | 250,000 |
| Pine Spring and sister mines | 75,000 |
| Blue Dick | 20,000 |
| Bigelow's | 5,000 |
| Tuscumbia | 20,000 |
| Groom Creek | 10,000 |
| Other mines | 10,000 |
| Total | 1,365,000 |

The Courier says: "The foregoing estimate takes in the value of bullion produced at home, of placer gold, and of lots of rich ores which were shipped to Pueblo, Colo., and Benson, Ariz., for treatment. The United Verde furnace has not been run more than six months. The Black Warrior mill (five stamps) has been run but a few months. The estimate does not include the yield of the Peck and Excursion mills, nor that of the Copper Mountain furnace. It is a rough estimate, but one which we are not afraid to have compared with those of Wells, Fargo & Co., and other makers of bullion statements."

It is supposed that in this estimate copper and lead are included.

I have estimated the production of this county for 1883 at, gold, $25,000; silver, $800,000; total, $825,000.

## YUMA COUNTY.

This county has a large area of mineral land, bearing gold, silver, copper, lead, and iron, which is awaiting development. The mines that are already opened are looking well.

The diversity of minerals, the abundance of wood, and the many ledges of paying ore will, when it can be supplied with water and proper transportation to facilitate, make it one of the most profitable mining counties of the Territory.

*Silver district* is 5 miles east of the Colorado River and 40 miles above the town of Yuma. The formation in which the veins are found is mostly granite and porphyry. The surface of the country is covered in many places with volcanic *débris*, and a conical peak in the northern end of the district has evidently been, at some time in the past, an active volcano. The croppings on nearly every ledge in the camp show the action of fire, while the hills and mountains evidence the same eruptive agencies.

The ores are principally carbonate and chlorides. There is also much argentiferous galena. The ore is found in combination with spar and quartz and large quantities of iron.

The veins are wide and well defined, and maintain a regular course—northeast by southwest—across the country.

The Clip is the mine now attracting most attention in this district. A road has been built from the mine to meet the county road, and the grading for the mill, at the river, commenced. The mine is about 7 miles from the Colorado, and 5 miles north of the town of Silcat.

The improvements on the property have all been made in an economical and systematic manner. The ledge is fully 125 feet wide in places on the surface, and can be distinctly traced beyond its side lines on to the Alberta mine. The ledge was cut at various places, shafts sunken, and samples are carefully taken from all the ore in sight.

The croppings and ledge matter cut by the tunnel are 150 feet high and give good No. 1 ore, ranging from 18 to 27 feet between walls; all pay ore. This rich body of ore is known to extend fully 300 feet in length, and how much farther can only be determined by exploration.

In addition to this great mass of ore uncovered, there is a large quantity of $20 rock, enough to run a mill for many years. Rock going $20 per ton in this mine can be worked to a large profit, as the ore is easily mined and little powder necessary.

Four men can take down 50 tons of mineral per day. This $20 rock is, however, only a reserve, as there is enough ore of a higher grade to keep the mill busy for two years. A cable road conveys the car loaded with rock to the ore-bin from the mine, the loaded car going down pulls the empty one back. The ore-bin is so arranged that it takes but a few minutes to load wagons. About 500 yards from the river stands the Clip mill. The building is of pine and the roof of corrugated iron. It is built for both comfort and utility, and the visitor is surprised at the cool atmosphere enjoyed beneath its hospitable shelter. The 10 stamps are crushing away, dropping at the rate of 112 times per minute and reducing the ore very fast. The rock is pliable and the stamps are "hung up" a good portion of the day, as the supply of pulp gets ahead of the pan capacity. The pans can manage 24 tons per twenty-four hours, and the 10 stamps can crush, if necessary, 50 tons per day.

The Alberta mine is the first extension north of the Clip. The formation of this claim is the same as that of its neighbor, and the ore rich chlorides and sulphurets. Fifty feet of shafting are being sunk.

The Red Cloud is the principal mine in the ore channel of the same name. It shows an immense outcrop, and has been sunk upon to a depth of 150 feet. From the croppings over $30,000 in black metallic silver was taken by the discoverers. This fine property passed into the hands of an Eastern company, who put up a smelter. The venture proved a failure, as the ore could not be treated by that process, and the mine is now lying idle.

The Nellie Kenyon adjoins the Red Cloud, and has over 3 feet of fine milling ore, averaging 40 ounces in silver to the ton.

The Rover, Melissa, Iron Cap, Engineer, Silver Glance, and Remnant, are on the same ore channel. Several of them have been opened by shafts from 50 to 200 feet in depth. The-ore bodies are large, although not of a high grade. With proper concentrating works they could all be made to pay handsomely. There is no better opening for such works in any other district in the Territory.

The Black Rock and Pacific Company is owned by a Boston firm. The main shaft is down 485 feet, all in pay ore, and cross-cut drifts and other workings on the ledge show up well. There is a large quantity of ore on the dump, and the furnace at the river is converting the ore into bullion. On the mesa adjoining the mine the company has erected a number of neat and cosy frame houses, where their employés are comfortably housed. Ore-houses, steam hoisting works, and all the necessary appliances of a first-class mine are placed conveniently. The camp is still in its infancy, but its future is very bright, and promises to give great wealth to the Territory.

*Castle Dome district* is situated 20 miles north of Yuma and 16 miles east of the Colorado River, surrounding the lofty natural "Dome" after which the range has been named. These mines were discovered in 1863, but owing to Indian hostilities work was not begun until 1869. Since then they have been shipping bullion almost continuously, and have proved to be among the most valuable mines of the Territory.

Although the grade is low, their proximity to the Colorado River and the cheap rates of freight to San Francisco have made them yield a handsome profit. The formation in which they occur is a porphyritic slate, and the matrix is fluor-spar and talcose slate. The ores are a galena and carbonate of lead, carrying about $35 in silver. They are concentrated, hauled to the Colorado, and shipped to San Francisco, where they command a good price for their fluxing qualities. The principal mines are the Flora Temple, Railroad, William Penn, Caledonia, and Pocahontas.

The William Penn, Railroad, and Pocahontas have been opened by shafts averaging 300 feet in depth, and by drifts and winzes. From the Pocahontas shipments of ore will soon be made. These mines are owned by the Castle Dome Mining and Smelting Company, one of the strongest mining corporations on the Pacific coast. Superintendent Farrar is crowding work on the mines. The two vertical shafts are being sunk night and day; shaft No. 1 is down 530 feet, and No. 2 is down 500 feet and promising well. The two shafts are connected at every 100 feet.

Back of Castle Dome Range, 50 miles from Castle Dome ledge, and 80 miles from Ehrenberg, an important discovery of gold placers has been made by Don Marcellino, an old resident of Yuma. The placers are 10 miles from water, and are being worked with dry washers. The pay dirt is from 4 to 5 feet thick, and the most gold is found in the gulches. Some $3,000 has been taken out in a short time. This discovery is of great importance to Yuma County, and with the steam dry washers now being worked at the old La Paz diggings, will add greatly to the product of gold from this section.

The Harcuvar mines are situated in the northeastern corner of the county, in the eastern foot-hills of a range of the same name. Upwards of $29,000 has been expended in actual work on the premises. The mines are distant from the city of Phœnix 90 miles by wagon-road, and are about 75 miles north of the Southern Pacific Railroad. They show an immense deposit of copper on the surface, in some places the ledges of ore are over 125 feet above the level of the surrounding country. Here, within a radius of 1½ miles from the enormous central ledge, are twenty-four claims that are being worked by the company, all of them having shafts or inclines from 10 to 40 feet in depth, and showing ore-veins with solid foot walls, the veins themselves being from 4 to 40 feet in width, and the ore being rich in quality. Some of the claims show a great deal of iron, and one of them is rich in galena. There is an abundance of wood in the surrounding country, but water has to be hauled a distance of 11 miles from Collins's Wells on the old Ehrenberg stage-road. Most of the ore-dumps are approached by carefully graded wagon-roads. The ore carries 20 per cent. in copper and $20 in gold and silver.

*Plumosa district.*—The Picacho group of mines, situated about 20 miles north of Picacho station, are looking better every day.

The Royal Mining Company's mill, of fifteen stamps, is proving a success. Twenty tons of gold quartz are worked here every day, and only $1.50 goes into the tailings.

Williams Fork is the oldest copper district in Northern Arizona.

The Planet, the Centennial, and the Challenge are the chief mines. A new smelter erected here adds another enterprise to the mining region of the Colorado River, and, with the valuable mining property owned by the company, the enterprise will not likely prove a failure. The management of this company is intrusted to a capable man, and he will undoubtedly make a satisfactory showing.

In the Eureka Cañon is the Governor Purdy, a valuable gold mine.

I have estimated the production of Yuma County during the year 1883 at: Gold, $30,000; silver, $75,000; total, $105,000.

*Revised list of mining districts in Arizona.*

| Name of district. | County. | Name of district. | County. |
|---|---|---|---|
| Tombstone | Cochise. | Myers | Do. |
| California | Do. | Copper | Do. |
| Los Cabazes | Do. | Cave Creek | Do. |
| Turquoise | Do. | Winnifred | Do. |
| Swisshelm | Do. | Aubrey | Mohave. |
| Hartford | Do. | Cedar Valley | Do. |
| Warren | Do. | Greenwood | Do. |
| Cochise | Do. | Maynard | Do. |
| Teviston | Do. | San Francisco | Do. |
| Russell | Do. | Hackberry | Do. |
| Winchester | Do. | Mineral Park | Do. |
| Globe | Gila. | Gold Basin | Do. |
| Mineral Creek | Do. | Bently | Do. |
| Richmond Basin | Do. | Last Basin | Do. |
| McMillenville | Do. | Minnesota | Do. |
| Mineral Hill | Do. | Little Cottonwood | Do. |
| De Frees | Graham. | Peacock Mountain | Do. |
| Bunker Hill | Do. | Wauba Yuma | Do. |
| Aravapai | Do. | Junction | Do. |
| Silver | Do. | Owen | Do. |
| Mayflower | Do. | Hualapai | Do. |
| Lone Star | Do. | Santo Domingo | Do. |
| Gold Gulch | Do. | Chloride Camp | Do. |
| Greenlee Gold Mt | Do. | Cole | Do. |
| Copper Mountain | Do. | Harshaw | Pima. |
| Ash Peak | Do. | Washington | Do. |
| Magazine | Maricopa. | Oro Blanco | Do. |

*Revised list of mining districts in Arizona*—Continued.

| Name of district. | County. | Name of district. | County. |
|---|---|---|---|
| Arivaea | Pima. | Pine Grove | Yavapai. |
| Tyndall | Do. | Tip Top | Do. |
| Aztec | Do. | Tonto Basin | Do. |
| Empire | Do. | Thumb Butte | Do. |
| Silver Bell | Do. | Croek's Canyon | Do. |
| Old Hat | Do. | Trinity | Do. |
| Pima | Do. | Weaver Verde | Do. |
| Papago | Do. | Walker and Lynx Creek | Do. |
| Greaterville | Do. | Copper Basin | Do. |
| Silver Hill | Do. | Castle Creek | Do. |
| Cababi | Do. | Helvetia | Do. |
| Helvetia | Do. | California | Do. |
| Copper Mountain | Do. | Castle Dome | Yuma. |
| Chiricahua Mountain | Do. | Silver | Do. |
| Patagonia | Do. | Poor Man's | Do. |
| Anmole | Do. | North Silver | Do. |
| Wrightson | Do. | Montezuma | Do, |
| Tueson | Do. | Ellsworth | Do. |
| Cañon d'Oro | Do. | Plomesa | Do. |
| Quijotoa | Do. | Weaver No. 1 | Do. |
| Pioneer | Pinal. | Weaver No. 2 | Do. |
| Mineral Hill | Do. | Humbug | Do. |
| Casa Grande | Do. | Eureka | Do. |
| Quajate | Do. | La Paz | Do. |
| Saddle Mountain | Do. | Bill Williams | Do. |
| San Pedro | Do. | Haieurar | Do. |
| Old Hat | Do. | Alvarado | Do. |
| Randolph | Do. | | |

# CHAPTER III.

## CALIFORNIA.

Gold mining in California during the past year, so far as indicated by the comparative results, has not been prosperous, for although the State still maintains its place, ranking first among the gold producing States and Territories, the annual yield continues to diminish.

In 1882 California added nearly $17,000,000 to the world's supply of gold, but in 1883 fell short of that amount almost $3,000,000 contributing only $14,120,000 to supply the increasing consumption of that metal. This decline was due in a measure to the gradual exhaustion of the richer deposits in the placer fields, in part to diminished returns from quartz mines, notably those at *Bodie*, but chiefly due to the discouragement and interruption of hydraulic mining, consequent upon the actual or threatened litigation, and the injunctions issued by the courts. These legal proceedings resulted in the suspension of work by many of the companies and miners operating the immense and rich gravel deposits of these ancient but now dead rivers, extending through Butte, Placer, Sierra, Nevada, and Yuba Counties.

The decision rendered on the "mining *débris*" question by Judge Sawyer during the year, in the case of Woodruff *vs.* The North Bloomfield Gravel Mining Company, involved consequences seriously affecting mining interests in many portions of the State, especially if the reasons given for making the injunction perpetual should be sustained by the Supreme Court.

The suit was brought to restrain several mining companies from discharging their *débris* into the Yuba River, which drains over 1,300 square miles of Sierra, Nevada, and Yuba Counties, containing deposits of over 700,000,000 cubic yards of auriferous gravel remaining to be worked.

It was charged by the complainants, and found by the court to be a fact, that in all the streams from the junction of Yuba and Feather Rivers, up to the vicinity of the hydraulic mines, the beds had been filled, and at some places to a depth of 150 feet; that over 15,000 acres of alluvial land had been destroyed, navigation impaired and the filling up of the present navigable rivers threatened. The water had become charged with gravel, and was wholly unfit for domestic use or even for surface irrigation; and were it not for the levees, much of the adjacent lands would be buried by *débris*.

The court held that other and more important industries had been damaged without due process of law and without recompense, and, after considering the various projects for dams as preventives of injury, the court held that they would be insufficient, and no alternative remained but to grant a perpetual injunction.

The effect of this decision, unless reversed by the Supreme Court of the United States, will, at least for some years, seriously reduce the production of gold in California.

Since the rendition of this decision more interest has been taken in "drift" and "river-bed" mining. For the latter the past year has been especially favorable on account of the drought which reduced the depth of water in the river beds.

A new method has been devised for reaching the bottom or gold-bearing layer in the beds of streams. It consists in placing in the center of the channel a large flume, into which the gravel is thrown by pipes, thus washing out the contents of the bed down to bed-rock.

On Coffee Creek still another method is used, namely, driving a tunnel under the bed of a stream and drifting out the pay ore. Should this latter plan prove successful it will be generally adopted, and will to some extent compensate for the diminution in the gold yield caused by the interruption of hydraulic mining.

In silver the yield of California has increased during the year over $600,000, due principally to the opening up and working on a larger scale of the numerous deposits of argentiferous ores in Calico district, San Bernardino County.

Silver mining in California has always been subordinate to gold mining, but latterly it has assumed greater prominence and importance. Rich silver mines have been worked for many years in Inyo County, and a rich silver belt was believed to extend through Fresno, Tulare, and San Bernardino Counties. Recently extensive deposits of silver were found in Fresno County, and the production of silver in San Bernardino County alone increased during the year nearly a million dollars.

The dividends paid by California mines during 1883 are reported as follows:

| | Dividends. |
|---|---|
| Black Bear, quartz | $18,000 |
| Bonanza King | 41,000 |
| Bulwer | 35,000 |
| Idaho | 34,100 |
| Jackson | 5,000 |
| Mount Pleasant | 90,000 |
| Napa Consolidated | 20,000 |
| Plumas Eureka | 140,626 |
| Plymouth Consolidated | 350,000 |
| San Francisco | 5,000 |
| Sierra Buttes | 61,250 |
| Standard | 325,000 |
| | 1,124,976 |

Eighty-three assessments were levied during the year on the stockholders of 54 mines and mills, amounting to $1,972,000.

The rates of wages paid miners and the number of persons engaged in that industry have not varied materially during the last few years. Of the mining population a large portion work their own claims. Many Chinamen are engaged in mining, mostly in working old river diggings and tailings. Those employed by mining companies receive much less pay than white men. Among the latter, first-class miners receive from $2.50 to $3 per day and ordinary miners about $2.

After a careful review of all the data and information in my possession bearing on the subject, I have estimated the production of California for the year 1883 to have been $14,120,000 gold and $1,460,000 silver; total of $15,580,000. This appears to have been obtained from the several counties, approximately, as follows:

| Counties. | Gold. | Silver. | Total. |
|---|---|---|---|
| Alpine | $10, 000 | $5, 000 | $15, 000 |
| Amador | 1, 590, 000 | | 1, 590, 000 |
| Butte | 630, 000 | | 630, 000 |
| Calusa | 1, 000 | | 1, 000 |
| Calaveras | 500, 000 | | 500, 000 |
| Del Norte | 135, 000 | | 135, 000 |
| El Dorado | 530, 000 | | 530, 000 |
| Fresno | 100, 000 | | 100, 000 |
| Humboldt | 80, 000 | | 80, 000 |
| Inyo | 90, 000 | 38, 000 | 128, 000 |
| Korn | 150, 000 | 5, 000 | 155, 000 |
| Lassen | 20, 000 | 5, 000 | 25, 000 |
| Los Angeles | 20, 000 | 25, 000 | 45, 000 |
| Mariposa | 220, 000 | 3, 000 | 223, 000 |
| Merced | 10, 000 | | 10, 000 |
| Modoc | 50, 000 | | 50, 000 |
| Mono | 1, 750, 000 | 290, 000 | 2, 040, 000 |
| Nevada | 3, 000, 000 | 8, 000 | 3, 008, 000 |
| Placer | 810, 000 | | 810, 000 |
| Plumas | 950, 000 | | 950, 000 |
| Sacramento | 480, 000 | | 480, 000 |
| San Diego | 50, 000 | 5, 000 | 55, 000 |
| San Bernardino | 30, 000 | 1, 050, 000 | 1, 080, 000 |
| Shasta | 210, 000 | 20, 000 | 230, 000 |
| Sierra | 1, 075, 000 | | 1, 075, 000 |
| Siskiyou | 400, 000 | | 400, 000 |
| Stanislaus | 40, 000 | 5, 000 | 45, 000 |
| Tehama | 10, 000 | | 10, 000 |
| Trinity | 400, 000 | | 400, 000 |
| Tulare | 4, 000 | 1, 000 | 5, 000 |
| Tuolumne | 320, 000 | | 320, 000 |
| Yuba | 455, 000 | | 455, 000 |
| Total | 14, 120, 000 | 1, 460, 000 | 15, 580, 000 |

The main portion of the following detailed review, by counties, of the mines of the State was prepared by Mr. J. R. Hardenberg, under the direction of E. F. Burton, superintendent of the San Francisco mint, but information furnished by correspondents or obtained by personal observation and from other sources has been added and incorporated therewith.

## ALPINE COUNTY.

Alpine County is bounded by the counties of El Dorado, Amador, and Calaveras, and by the State of Nevada. It lies south of the famous Comstock lode of Nevada, being about 50 miles distant. The Carson River heads in this county and flows down by the base of Mount Davidson.

The mining interests have not been as active during the past year as the most sanguine could have desired; still there was much prospecting done and valuable discoveries made.

The Stella mine.—Mr. Cyrus Coleman states that this was the only productive mine in 1883 in Alpine County. The ore, he says, was extracted from the 220-foot level, to which the shaft was sunk during the year, and $900 in gold and $11,000 in silver was obtained. The sinking of the shaft will soon be resumed, as it is known that a fine body of ore extends down from this level. The other mines belonging to the Isabella Company, of London, were not worked during the year.

The Orion mine lies south of the Stella mine. Prospecting was continuously prosecuted during 1883, and much valuable development made. A prospect tunnel was run from the southeast side of the mountain, which cut the ledge at a depth of 50 feet. This tunnel was run for the purpose of ascertaining the course and pitch of the ledge. The ledge was found to be 40 feet wide, the course north 30° east, and the dip less than 28° east, the ledge showing well in gold and silver, carrying chlorides and argentiferous lead and copper ores. The main or lower tunnel will cut the ledge at a perpendicular depth of 275 feet from the surface. The tunnel has been run 675 feet, and is expected to cut the vein in less than 200 feet from the present terminus. Very rich feeders of gold, silver, and lead have been encountered in the main tunnel. The country rock is porphyry and limestone. It is reported to be the intention of the company to develop the mine fully before they erect machinery to reduce their ores.

Colorado No. 2.—But very little work was done on this mine during 1883. Negotiations are still pending for the transfer of this property to London capitalists and an early sale is expected.

North Colorado.—This claim adjoins the Colorado No. 2 on the north. Work was steadily prosecuted during the year 1883, and the improvements now consist of 275 feet of tunnels and shafts. The claim shows well in argentiferous lead ore on the surface. The main tunnel is expected to strike the lode within 50 feet at a depth of 100 feet. Cyrus Coleman, of Markleville, is the owner of this claim.

The Polaris adjoins the Colorado on the north. During the year 1883 important developments were made near the surface, ore assaying several hundred dollars to the ton in gold and silver being found. The improvements consist of about 100 feet of tunnels. D. K. Hawkins and T. M. Hanson, of Markleville, are the owners of this claim.

The Last Resort is located about 1 mile southwest of Monitor, and is owned by John P. Ray, of Monitor, Cal. Prospecting on this claim is being prosecuted with much vigor. The improvements consist of 850 feet of tunnel. The owner is sanguine of striking the lode, which shows well on the surface, within 50 feet of the present terminus of the tunnel, at a depth of 326 feet from the surface.

The Illinois-California Silver Mining Company's claim was further operated upon during the year, and now has completed over 2,000 feet of tunnels and drifts. It is expected that during the year 1884 this claim will be fully developed. The office of the company is in Chicago, Ill.

Many other valuable mining claims are held in the county, whose owners are awaiting the development of more prominent claims, when operations will be resumed.

## AMADOR COUNTY.

Amador County is bounded on the north by the Consumnes River, on the south by the Mokelumne River, and west by the counties of Sacramento and San Joaquin, while its eastern portion terminates almost in a point up to the summit of the Sierra Nevada Mountains. In territory Amador is small, being about 50 miles in length, with an average width of about 14 miles, but in mineral wealth it takes rank amongst the first-class counties of the State. There are three extensive valleys in the western portion of the county, viz, Ione, Jackson, and Buckeye, which are made up of fine agricultural land, being particularly well adapted to fruits and vineyards. The mining districts are found at an elevation of about 1,500 feet, extending easterly up the Sierras. The climate is very fine, the greater portion of the county lying below the snow belt, yet sufficiently high to escape all miasmatic diseases. It is easy of access from the cities of Stockton, Sacramento, and San Francisco, having railroad communication with all these places.

The principal mining industry of the county is quartz, which is being carried on with great energy and success. Upon the immense belt or zone of gold-bearing quartz, commonly known as the great mother Lode, are located the largest and best-paying gold quartz mines in the State. This great lode extends across the county from the Mokelumne River to the Consumnes, and even into El Dorado.

Although the mother lode in Amador County has been profitably mined for many years at different points, still many failures have occurred from lack of experience and extravagance in management. These conditions are rapidly being changed, and success generally is taking the place of former failures. Some of these mines, notably the Zeile, at Jackson, have demonstrated the fact that ores yielding from $3 to $6 per ton can now be made to pay handsome dividends. The result is that this vast deposit of low-grade quartz in the mother lode is rapidly being brought to the notice of mining men and capatalists, and locations along the lode are eagerly sought. The time is not far distant when, as its advantages offered for mining and milling ores cheaply become known, this locality will become the center of the great quartz-mining industry of the State. This county, more fortunate than most of the others, has not suffered during the past year from a lack of water, which is furnished by the Amador Canal to all the mills at Plymouth, Drytown, Amador, Sutter Creek, Jackson, and the mines in Hunt's Gulch. The canal is 46 miles in length, 8 feet in width on the top, and 5 feet at the bottom, carrying 4 feet depth of water. It receives the water from perennial lakes high up in the Sierra Nevada Mountains. There are a series of lakes, the largest of which has an area of 6,200 acres. The capacity of this has recently been increased by an additional heighth of 12 feet in the dam at the outlet, which now holds sufficient water for all purposes during any season.

Upon this lode is located the Plymouth Consolidated mine, which was located in 1852 by Messrs. Hooper & Co., but is now owned and worked by Hayward & Hobart, of San Francisco. The mine has a length of 3,000 feet on the lode, and has been developed to a depth of 1,400 feet, with various levels run and stopes opened up, and is producing more bullion than any other gold mine in the State. Two water-power mills of 40 and 80 stamps, respectively, are kept constantly running on ores from the mine. The 80-stamp mill receives its water supply from the Consumnes River through a ditch, which is also utilized for bringing timbers and lumber for use at the mine. The 40-stamp mill receives its water supply from the Amador canal. The two mills crush about 250 tons of rock every twenty-four hours, the results from which pay large monthly dividends, and from present appearances will continue to do so for years to come.

At Drytown is located the Seaton mine, recently purchased by Hayward & Hobart, which has a 20-stamp mill with all modern improvements for properly working the ore. The mine is now being developed.

Next and adjoining the above is the Loyal, owned by a Boston company, and is being opened up. It also has a 20 stamp mill.

The water supply for the last two mentioned mines is obtained from the Amador canal.

One and one-half miles west from Plymouth the Page Brothers have a ledge or mine called the Ochre, with a shaft 70 feet in depth and a drift running north 70 feet, and one running south 60 feet. The ledge is 18 feet thick, and, although no stoping has been done yet, they have taken out some fine rock.

The Bunker Hill mine is located near Drytown, and is being worked with fair results. It is opened by a shaft 700 feet deep, and has a 40-stamp water-power mill, the water being furnished by the Amador Canal Company. This mine has been in operation for the last eighteen years.

The Wabash mine is situated between Sutter Creek and Amador City. Some four or five years ago it was worked on a small scale by arrastras, and paid well. For years afterwards it remained idle; recently, however, work was resumed by driving a tunnel into the hill, which has encountered a ledge, 20 inches thick, which shows free gold of wonderful richness.

Keystone Consolidated, located at Amador City, 5 miles from Drytown, was originally owned by A. H. Rose, who sold it to its present owners. There are two shafts 1,000 feet in depth, being 600 feet apart. The shafts are on an incline of 60°. Levels have been run at every 100 feet from the surface down to the 1,000-foot level. Drifts or levels extended 350 feet north from the north shaft, and 150 feet south from the south shaft, making the levels 1,100 feet in length. No ore has, thus far, been extracted below the 500-foot level, yet the chute has been developed to the 1,000-foot level, and carries its full strength all the way down. The fissure is 40 feet wide, with a large proportion of it pay ore. Experts who have recently examined this mine say that there is sufficient ore already opened up to keep the 40-stamp mill in constant operation for six or seven years to come. The water supply is obtained from the Amador Canal Company. The rock averages $14 per ton in free gold, and from $2 to $3 per ton of sulphurets. This is one of the most reliable dividend-paying mines in the State, having paid regular dividends for the past eighteen years.

The South Spring Hill mine, near Amador City will, probably, it is claimed, soon be added to the list of bullion-producing mines of this county. The mine has been steadily prospected for four years past without a color. When the shaft had reached the depth of 600 feet a drift was run eastward 60 feet which opened into a fine body of quartz in granite and slate formations. The ore is streaked with dark lines, and commonly known as ribbon rock, very similar in general appearance to that met with in the Keystone mine. It carries a large percentage of sulphurets, and assays have given as high as $500 per ton. The Talisman mill, purchased by this company, is within a few hundred yards of the mine, and is being put in order to crush rock from the mine.

*Sutter Creek.*—At this place a new mine is being developed, known as the Iowa, owned by Tibbets & Co. In December, 1883, the mine yielded $19,000, in January, 1884, $25,000. The ore is very rich, being worked in a 5-stamp mill.

The Lincoln mine at this place, which has been closed for the last five years, has commenced operations anew. Recent developments in the vicinity gives good encouragement for the future. The mine is supplied with a 40-stamp water-power mill.

The next mine on the lead is the Mahony, which was worked successfully for years, but, from bad management and litigation among the owners, it has been closed down. It is, however, about to change hands, and is to be worked in connection with the Wildman, which adjoins it. Large reserves of ore are reported to be in both these mines.

The Consolidated Amador has been successfully worked, and has returned a large amount in dividends to its owners. Owing to a fire in the old shaft operations have been suspended in the mine until the new shaft, now being sunk, is completed. The new shaft is now down 1,200 feet, and drifting will commence immediately to open out the old workings of the mine. The company own a 40-stamp water-power mill, supplied with water from Sutter Creek.

The Zeile mine, located at Jackson, the county seat of Amador County, has been worked for many years with varied success, but not, until it came into the possession of its present owner, with much profit. Dr. Zeile purchased the mine about three years ago and erected a new 40-stamp water-power mill, chlorination works, &c., and is working it systematically and cheaply; has paid well. The shaft is 800 feet in depth and levels 900 feet in length. The ledge is 35 feet wide, and yields about $2.50 per ton in free gold and $3 per ton of sulphurets. The mill crushes 120 tons per day, and fully demonstrates the fact that with all the modern appliances, viz, rock-breakers, self-feeders, concentrators for successfully collecting the sulphurets, and water-power to do all the labor and work, very low-grade ore can be made to return very handsome profits.

*Volcano*, which is 12 miles from Jackson, has a number of good mines, among which may be noted the Downs mine, which has been worked for the past five years. The shaft is down 700 feet, with levels run every 100 feet from the surface, and is paying a fair profit. Ore has been extracted to the 500 foot level, and on constant increase in value as depth is attained. The vein is 5 feet thick, and the ore pays $10 per ton, and is worked in the company's 20-stamp mill, which is supplied with all the modern improvements and run by free water.

Mason's prospect, on *Gray Gulch*, is also looking well. He has a 3-foot ledge, with well-defined walls, and a pay chute of $40 ore, 200 feet in length.

The Modoc, at this place, has 150 tons of ore on the dump, which is expected to yield $40 per ton. A 10-stamp mill is attached to the mine, and the ore is so easily taken out that six men can keep the mill running.

The Stocken also has about 25 tons of $60 ore on the dump, and the mine is looking well.

At the Gillicks & Phelps mine good rock is being extracted, which seems to increase in value as depth is attained.

Ball Brothers have reopened their gravel claim by means of cutting a race 200 yards long and 50 yards wide by 70 feet in depth. They have commenced tunneling with a 9-foot bank of gravel, which will pay well.

A short distance above *Big Bar*, on the Mokelumne River, is located the Tripp & Littlefield mine, which is being prospected, and opened by the use of a 1-stamp Kendall battery, which crushes 2½ tons of rock in twenty-four hours. The prospects for a mine are excellent.

Confidence mine, 2½ miles southeast of Jackson, is opened by a tunnel 180 feet in length, showing a 5-foot ledge of good pay rock. A new 5-stamp mill has been completed which crushes 12 tons per day, which yields 500 pounds of sulphurets, worth $120 per ton.

*Hunto Gulch*, which empties into the Mokelumne River at Middle Bar, has been a point of great interest and excitement during the past year in consequence of the discovery of fabulously rich quartz rock. Located here is the Amador Queen mine, with a shaft 200 feet deep, showing a ledge 40 feet wide for 1,500 feet in length, all of which prospects well. A short distance from the Queen mine the same company own another ledge into which a tunnel has been run 1,050 feet, showing a fissure 120 feet in width of vein matter, with several small veins of good ore in it. The company intend building a 40-stamp mill in the spring of 1884.

The Kelley mine is located on Murphy Ridge, 2½ miles south of Jackson. The ground held by the company comprises two locations of 1,500 feet each, the McKay & Love and the Kelley, the latter of which is now being worked. A tunnel has been run north into the ridge a distance of 700 feet, and in the face of the tunnel the ledge is 8 feet wide. The first cross-cut is run to the west 280 feet from the mouth of the tunnel. It has been run 160 feet. At 106 feet from the tunnel it cuts the ledge, which is 5 feet in width. The second cross-cut is run in the same direction, starting within a few feet of the mouth of the tunnel, and cuts the same ledge found in the first cross-cut, 49 feet from the tunnel. This cross-cut is in 195 feet, and is running to connect with the shaft ledge. The shaft is now down 115 feet and will have to be sunk 140 feet farther, in order to connect with the second cross-cut from the tunnel. The ledge is 4 feet wide in the bottom and is good-looking rock. The mine can be worked very cheaply, as there is rock enough above the roof of the tunnel to keep their 20-stamp mill running for several years.

Doyle claim, in Hunt's Gulch, is looking well, and recent developments in their tunnel are of a very encouraging character.

The Saint Julian quartz mine is situated near Middle Bar, on the main mineral belt, near the celebrated Mammoth mine. The mine has been bonded to Messrs. Moore, Conlon & Co., who are prospecting the mine by running a tunnel into the claim in a northerly direction. The tunnel is in about 115 feet. About 40 feet from the surface a rich vein of quartz was encountered showing decomposed quartz, slate, and quite a good percentage of sulphurets. The ore is very heavy and of the same general character as that found in the Mammoth, except that it does not carry so large a percentage of gold. As far as explored, the vein is from 6 inches to 1 foot in width, and increases in richness and widens as depth is attained. The prospects of uncovering a "bonanza" are very flattering, and bids fair to be a mine of surpassing wealth.

Mammoth, or Nevills, mine is situated on the range between Murphy's Gulch and the Mokelumne River, at Middle Bar, 3½ miles south from Jackson. The claim was known for years as the Spanish Gulch mine, and was worked in former years by Mexicans, and quite a large amount of pay ore taken out, up to the time that water was struck in the shaft, when work was suspended and the mine passed into other hands. A few years since it fell into the hands of its present owner, Mr. Nevills. During the past season a fine development was made by striking a pocket of almost unparalleled richness, less than 100 feet from the surface. From this pocket about 2 or 3 tons of ore was taken, from which about $80,000 in gold was taken. Much of it might be called chunks of gold instead of gold-bearing quartz. Some of the pieces were immense, the largest being oval in shape, about 16 by 20 inches and 6 inches in thickness. The ledge is 5 feet in thickness, and in this pocket the whole face of the drift seems to be bound together with strings and spikes of gold.

The shaft is 100 feet deep and located about 600 feet from the western limit of the claim. The 10-stamp mill has been put in order, and a ditch constructed to convey water from the Amador Canal Company's ditch.

A tunnel was started some time since to tap the ledge 300 feet below the bottom of the shaft, and in this tunnel, 150 feet from the mouth, a new and wonderfully rich ledge of ore was encountered, showing ore fabulously rich in gold.

A second tunnel has also been started 500 feet lower down, which in magnitude and great object to be accomplished eclipses anything of the kind ever undertaken in this county. "The point selected for the tunnel is opposite the boom of the Gwin mine, nearly a quarter of a mile from the river. To get the tunnel fairly inaugurated has involved an expenditure of $10,000. A long shed has been erected close to the mouth, where a Richmond air-compressor, run by a Pelton wheel, with 25 inches of water, and designed for two drills, has been erected. Blacksmith shop, &c., are also to be found here. The Richmond compressor, manufactured at Marysville, works admirably. It is supplied with a small stream of water from a tank overhead."

The drills are from 18 inches to 6 feet long. The point that strikes the rock and does the boring is in the shape of a cross, sharp, and made of hard steel. When under full pressure it gives 300 blows per minute. At each stroke the drill turns one quarter round, so that each blow the sharp edge strikes a different point. By this means a hole is bored into the solid rock 5 feet in depth in half an hour. From 8 to 10 holes are charged and fired at a time, which fills the tunnel with *débris*, or loose rock. Two sets of holes are fired every twenty-four hours, so that the tunnel is advancing at the rate of 8 or 10 feet per day. The tunnel is 8 feet in the clear, supplied with a double track laid with railroad iron. An electric battery is soon to be used to fire the blasts, which will insure the simultaneous explosion of all the blasts.

The people hardly realize the vast scope of this undertaking. The idea seems to be that it is simply to operate the Hamilton and Mammoth mines, which lie immediately north of the tunnel. This is one of the objects of the projectors, but only one, and perhaps not the most important one. After running over 1,000 feet the tunnel will strike the ledge in the Hamilton ground at a depth of 800 feet from the surface, and when it reaches the Mammoth shaft, another 1,000 feet beyond, it will be over 900 feet from the surface. It is not intended that the tunnel shall stop when it reaches the limit of the Mammoth ground. Before reaching that distance an arrangement will doubtless be made with the owners of all claims along the main belt clear through to Jackson, if not beyond, by which the tunnel owners will acquire certain rights in the event of their claims being worked by means of the tunnel. It would tap the Zeile mine at a depth of 1,300 feet, far below the deepest point yet attained.

The mineral resources of the region between Jackson and the Mokelumne River, on the line of the quartz belt, are comparatively untouched. Except at the Zeile mine, not a shaft has reached anything like a depth of 400 or 500 feet; but the magnificent developments at the Mammoth mine warrant the conclusion that this belt, or zone, is destined to be the banner gold-yielding district of Amador County and the main quartz lode of the State. By means of this tunnel $4 or $5 rock can be worked at a profit, and when it is known that ore far exceeding that in quality exists through the mother vein the importance of this tunnel undertaking to the mining industry of the county can hardly be overvalued.

Gravel mines.—At Volcano, 12 miles from Jackson, is located the extensive gravel mine belonging to the estate of the late Charles McLaughlin. This claim embraces about 1,000 acres, and is considered inexhaustible. The *débris* from the mine is easily impounded, and the large ditch, 18 miles in length, supplies an abundance of water. The property is paying well.

The McCullough gravel mine, at Grass Valley, now owns the old Pioche ditch, which takes water from the Mokelumne River at Panther Creek. The ditch is 21 miles in length and carries 1,000 inches of water.

The Blue Gravel mine is located on the Wise Toll road, 9 miles above Sutter Creek. The claim embraces about forty acres, every portion of which prospects well, from the surface to bed-rock. This mine is favorably located, being below the summit of the ridge, upon which a large reservoir has been constructed.

The Lamping gravel claim at Ione Valley is working again, after lying idle for some time.

At Slabtown, near Jackson, Messrs. Fulcher & Bartlett Brothers have a gravel claim which is paying a small profit.

In the vicinity of Volcano Messrs. Burtling & Co., Whiting & Co., James Shilor, Parberry & Co., Nixon & Co., McCresby & Co., Halsey & Co., James Hall, and Headly & Co. are running their respective gravel mines whenever water is available, and all are paying something.

The quartz mines in this vicinity which are being opened up are the Ross and the Terrence & Gillick, J. B. Pine, Contreras, Bowers, John Johnson, Jacob Gresbach, Colken, Saint Louis, Wheeler, Martha Washington, John Dane, and Healy & Co.

At Volcano the Doolittle mine has a tunnel 2,200 feet in length and are prospecting for paying gravel.

Healy & Vain, at Posey Hill, near Volcano, are working a gravel claim, which is yielding a fair profit over expenses.

## BUTTE COUNTY.

This county is one of more than medium importance in the State, both in its mineral and agricultural productions. It embraces an area of some 1,800 square miles, the western portion of which is composed of the valley lands of the Sacramento and Feather Rivers, including therein many thousand acres of valuable grain land. The valley portion of the county is traversed by two railroads, viz, the California and Oregon, entering the county from the south and traversing the eastern side of the valley of the Sacramento for a distance of over 40 miles; and the California Northern, which also enters the county from the south at the Honcut, and extends to Oroville, a distance of some 14 miles. This latter railroad was built with a view to opening up the mining country, and extends from Marysville to Oroville, a distance of 26 miles.

Oroville is a mining town which sprung into existence in the summer and fall of 1855, upon the completion to that point of the Feather River and Ophir Water Company's ditch, which, taking water from the South Fork of the Feather River, carried it a distance of 40 miles and distributed it over the bluffs and foot-hills surrounding the town. These mines maintained an extensive population until the Frazer excitement and the discoveries of mines in the Territories of Nevada, Idaho, and Montana started the ever restless population on the hunt for new discoveries.

Ophir, on Feather River, where Oroville now stands, was a central place for the gathering of the Eastern pioneers of '48 and '49, and within a distance of 8 miles contained a population of about 5,000 souls.

This pioneer population hastily appropriated the surface gold fou on the bars of the rivers and in the gulches and cañons where water could be procured. It was not, however, until the completion of the Feather River and Ophir Water Company's ditch, in 1855, that the mines of the vicinity were thoroughly worked. For miles the surface of the earth was washed away, the cañons and gulches worked to the bed-rock, and the bluffs honey-combed with tunnels.

Feather River, too, from Hamilton Bend to Union Bar, a distance of nearly 40 miles, was flumed and the bed of the stream worked for river dust. The impetus given to this industry carried it over the territory known as Ophir, Wyandotte, Oro, and Mountain Spring Townships. This entire scope of territory, with the exception of the Forbestown and Mooreville ridges, are worked out and generally abandoned for anyting like extensive mining operations. Where the production formerly reached into the hundreds of thousands, it is now scarcely sufficient to estimate.

Forbestown is still a mining camp of considerable importance, both in placer and quartz. There are quite a number of quartz-mills in this vicinity, which it is believed will ultimately be found upon thorough and systematic work to be lasting and profitable.

Clipper Mills takes its name from the saw-mills in this vicinity. It is a timber region, and but little mining is now being carried on. Sufficient work has been done on the King Bird hydraulic mine to hold the claim.

Fairview.—The quartz mine at this place was started up anew about a year since, a small 5-stamp mill being put in operation for the purpose of testing the ore. At one time the outlook was considered favorable, but nothing has been developed worthy of note.

Mooretown and Mooretown Ridge are still worked to a considerable extent in both quartz and gravel mining. The Baranka ledge has a 5-stamp mill, and several ledges have been prospected during the past year.

The principal gravel mines are the Dodson and the Frost and Reese hydraulic mines. These two mines adjoin each other and the character of the gravel is the same in each. Both have a great drift of gravel. The Dodson mine is supplied with water from Lost Creek, by a ditch some ten miles in length, the water season lasting from three to four months. The Frost and Reese mine is supplied with water from the South Fork of Feather River by a ditch twelve miles in length, and have a supply of water from ten to eleven months of the year. There has heretofore been a great deal of mining in Bidwell Township, which embraces all the territory in Butte County lying between the North Fork of the Feather River and the Middle Fork. There appears to be but little mining on Bidwell Bar.

The country above mentioned embraces all the mineral portion of Butte County lying east and south of the main Feather River, usually known as the North Fork, and which originally was a rich mining section. The mines were supplied by three principal ditches and numerous smaller ones running from gulches and ravines that furnish water during the rainy season. There were the Feather River and Ophir, the South Feather, and a ditch taken from Berry Creek and running to the flat on the north side of the Middle Fork of the Feather opposite the once famous mining town of Bidwell Bar. But a small portion of the water now carried by these ditches is used for mining, but is also sold for irrigating purposes.

Even Oroville is no longer regarded as a mining town, and the Chinese are fast disappearing from the lava beds. The idea entertained years ago, by the Secretary of the Interior, that the country could be used for agriculture and horticulture after being mined out, seems to be realized in the vicinity of Oroville. In fact, the shutting down of hydraulic mining has left this vast section of mining ground nothing else to do. Of course there are some isolated mines in the vicinity, and it is not impossible that deep gravel beds may yet be found that will prove profitable.

Crossing the main Feather opposite Oroville, that portion of the country lying west of the North Fork and east of the valley furnishes about the only profitable field for mining in Butte County.

On the north side of Feather River and west from Oroville are what were once the famous Rancheria diggings, now occupied only by a few straggling Chinese.

What was known as the Powers claim lies higher up the river. It has not been operated since the suits against hydraulic mining. A ditch some 25 or 30 miles in length furnished this claim with water.

Adjoining the Powers claim on the east is the Miocene, an excellent hydraulic claim that has been worked but a few days. In connection with this claim is a ditch that cost something like a quarter of a million of dollars. The mine was closed by injunction from the United States district court, shortly after it had commenced work, and has lain idle since.

Adjoining the Miocene claim, and running into Table Mountain with a tunnel, is the Treasure Box, an experiment that seems not to have resulted profitably to its projectors.

Adjoining the Miocene on the east is the Hendricks hydraulic mine, with a fine ditch attached. It is also idle on account of the injunction against hydraulic mining.

There are several other mines in Morris Ravine upon which but little work has been done, while high upon the mountain side may be seen Monte de Oro, a drift claim that has paid well and is still yielding gravel.

Running parallel to Morris Ravine and east of it is Oregon Gulch, a locality that contains nearly all the quartz ledges of the county that have been successfully worked. William Nesbit has a quartz claim here that has been worked with varying success since 1849.

There are other locations which have been worked with varying success. The principal quartz claim of this vicinity, however, is the Banner quartz mine, situated on the rise from the river, between Morris Ravine and Oregon Gulch. This claim was located by Messrs. Smith and Sparks in 1849, and was successfully worked by them until 1859, when the ledge was lost.

William S. Nisbet, of Cherokee Flats, writes: "Cherokee Flats is located on the divide at the head of Oregon Gulch, at the base of Table Mountain. Here is located the hydraulic mine of the Spring Valley Company, supplied with water from Concow and Butte Creeks. The company has erected several dams in succession for the retention of the detritus from the mine, built many miles of canal to convey the waste water, and purchased many thousands of acres of land to be used as a dump, or, rather, because it was more or less damaged by the *débris* from the mine. With all these precautions, the company are still subject to suits from the farmers in the valley below."

*Sinclair Flat* is some 3 miles to the north of Cherokee. It has been a mining district since 1849, and still has one or two paying mines.

*Big Bend.*—To the northeast from Cherokee, and across the western branch, is situated the Big Bend Claim, which contemplates draining some 12 miles of the North Fork of the Feather River by a tunnel through the mountains of over a mile in length. Operations have been going on for the past year in this claim, and the tunnel is in a distance of about 3,000 feet. It is by far the most gigantic mining scheme ever attempted in California, and, if successful, will probably produce more fine river gold dust than was ever taken from all the river claims heretofore worked in this county.

The *Yankee Hill* and *Frenchtown districts* have almost ceased to attract attention as mining sections, although that industry is still carried on to a limited extent. This region contains quite a number of quartz ledges, which have been prospected to some extent, and may, when worked, prove valuable.

The Kimshew mines, of Kimshew Township which embrace a large extent of territory lying west of the west branch of the Feather River and east of Chico Township, have been worked during the year with average success.

The *Magalia Ridge* has always been a good paying district. The mines on this ridge are mostly drift mines, and there are several that have penetrated to ancient channels that are proving very rich.

On the Pershbacker the tunnel is in some 2,500 feet, and the channel being worked is very rich. Some $200,000, it is said, has been taken from this mine; much of it, however, in coarse gold. Considerable machinery has been added to the mine during the past year. It employs some twenty or thirty men. The Indian Spring mine and the Lucky Strike Mining Company are being worked successfully, although the main channel, for which the tunnel has been running, has not been reached.

*Nimshew district.*—The several mines in this district are being worked with more or less success—the Kirk and Cole tunnel, the Hupp claim, and the Shepherd claim.

The Meredith quartz mine is running a 5-stamp mill by water-power. Other quartz claims are being prospected with encouraging results in this vicinity.

The surface diggings at Lovelock, Inskip and Powelltown are being worked, but not with the push and vigor which have characterized them in the past years.

The cañons of Butte Creek and its branches afford some good mines.

The *Mineral Slide district* is on the branch of Butte Creek running northwesterly, and the cañon traversed to reach this claim looks as if its bounds had been set by vast upheavals of slate, sandstone, and silicious schists of the Paleozoic age, so abrupt and rugged are some of its mountain sides. Although seeming impossible that the erosion of water could form such cañons, they present evidence of plutonic origin; while upon some of the higher points stand formations of sandstone resembling crumbling piles of architecture which could only have been left there by the action of water in wearing away the more yielding portions.

The La Monte claim, at Mineral Slide and the Pershbacker tunnel, higher up on Little Butte, are the more notable mines on this stream, and both are rich and productive. Small ranches, orchards, and vineyards are interspersed with the mining claims, and seem to be contesting with them for the possession of this beautiful cañon. On all sides are found mineral deposits of fine washed gold.

On Table Mountain are found the same characteristics, only just north and west of Feather River the mineral belt encircling it seems to be farther removed.

Below this, on Butte Creek, is the old mining town of Diamondville, occupied by one or two ranchers, and only mined by Chinese. To the north and above lie the mines of Butte Creek, which extend to the point known as the "Forks of Butte," and are still successfully worked. Above are the Portuguese and other mines, affording profitable employment for a number of men. The bars and branches, as well as those of Butte Creek, also afford profitable employment for many persons.

## CALAVERAS COUNTY.

That portion of the mineral region of the State of California which now comprises the county of Calaveras was the scene of some of the earliest mining operations on the Pacific coast. Rich and extensive placers were found here shortly after the first discovery of gold at Sutter's mill, and from that time down to the present Calaveras has stood in the front rank of the leading mining counties.

No county was richer or livelier in the palmy days of early times than "Old Calaveras," and to-day none has more flattering prospects for a prosperous future. As the shallow placers became gradually exhausted "deep digging" and quartz mining succeeded the hydraulic, and stamp battery took the place of the pick and "long tom."

There is perhaps no part of the mining section of the State that affords inducements superior to those of Calaveras to either the capitalist or prospector. The field for mining operations is broad and attractive, and is not so completely occupied as in many other localities. There are still abundant opportunities for the prospector, while promising, partially developed properties are to be had by those who wish to invest coin instead of muscle in mining enterprises. Calaveras is centrally located, reference being had to the mining section, embracing a triangular strip of country bounded by the Mokelumne on the north and the Stanislaus River on the south. It touches Alpine County on the east, extending nearly or quite to the summit of the Sierras in that direction, while the western extremity borders on the great valley of the San Joaquin. Calaveras is exceptionally well watered. The Mokelumne, Calaveras, and Stanislaus Rivers, and their numerous branches and tributaries, form a net-work of natural water-courses, which have been supplemented by a series of extensive ditches ramifying throughout the county, affording excellent advantages for motive power and the favorable conduct of mining operations.

In all sections of the county quartz mills are run cheaply by water-power, while there is scarcely a gravel deposit anywhere that is not commanded by either a natural or an artificial supply, advantages that have materially assisted developments. Calaveras has a greater area of gold-bearing quartz zone than any other in the State. In addition to the mother lode, which traverses it uninterruptedly from north to south, there are an infinite number of smaller ledges, ramifying in every direction through central Calaveras, fairly ribbing a longitudinal section fully 25 miles in width with lodes of auriferous rock. Many of these minor ledges have been developed into paying properties, and hundreds of others have been sufficiently prospected to demonstrate the general fact that only capital, directed by judicious and systematic effort, is requisite to render their working remunerative.

It is for these reasons—for the very desirable fact that there is wide scope for new developments as well as opportunities for paying investments by capitalists—that the mining interests of Calaveras are receiving a large share of public attention to-day. In addition to this is the very important circumstance, that the constant improvement in the methods and appliances for both mining and extracting the gold from quartz are steadily broadening the field of operations, by rendering the successful working of lower grades of ore possible.

With the gradual reduction of the cost of mining and milling, together with the increased percentage of gold saved, the day is not far distant when ledges that now lie in enforced idleness will be worked remuneratively. Under the belief in a more favorable outlook for mining enterprises, developments are being pushed in all directions with pleasing results, stimulating research, and pointing to the most flattering prospects for the quartz-mining interests in the future.

Within the last decade a radical revolution has been wrought in the methods of gravel mining. Not only has the scene of active operations been transferred from the gulches, river beds, and shallow placers to the hills and deep channels, but the methods of working and appliances have been completely metamorphosed. Water under hydraulic pressure, supplemented by the assistance of gunpowder used in shattering and pulverizing the gravel banks, has in a great measure supplemented muscle as a factor in mining operations of this character, increasing the quantity of dirt washed a thousand-fold.

Calaveras has rich and extensive gravel deposits, which are being worked to a considerable degree, but not upon so broad a scale as will follow the increase and cheapening of the water supply. New deposits of auriferous gravel are frequently discovered, and operations upon well-known channels are enlarging in scope and number. A very promising discovery has recently been made in the northeastern portion of the county, in the vicinity of Railroad Flat. A channel, evidently the bed of an ancient river, has been penetrated by shafts for a distance of over 2 miles in length, uncovering gravel of extraordinary richness. The gravel is beneath a stratum of lava 40 feet thick. The new discovery lies south of and parallel with the north fork of the Calaveras River, and is being prospected with the most favorable results. It is safe to say that the gravel-mining interests of Calaveras have not been in so prosperous a condition nor offered so hopeful an outlook for the future since the flush times of early days as at present.

In addition to gold, there are in Calaveras mines of copper, iron, manganese, chrome, quarries of excellent marble, and deposits of kaolin. These will soon become productive, as the completion of the railroad, now building, will furnish the necessary facilities for their transportation.

*West Point district.*—Quartz mines.—Considerable activity is being manifested in this district, although there are a number of mines and promising locations idle for lack of capital. Complaint is made that a large area of the public lands, embracing lodes of gold-bearing quartz, has been pre-empted and homesteaded to the great detriment of the mining interest. There is good authority for saying that by the expenditure of the requisite capital, West Point district would produce $1,000,000 annually for the next fifty years.

The Lone Star mine, Reid & Hillary owners, is a promising property. It is worked through three tunnels and a shaft. Length of lower tunnel, 400 feet; depth of shaft, 175 feet; ledge varies from 20 inches to 25 feet in width. Average yield of rock per ton, $80. Number of men employed, 4.

The Ohio Consolidated, formerly known as the Woodhouse mine, owned by Desmond & Co., is worked through two tunnels from the bed of the river 1,000 feet below the top of the ridge upon which the vein crops out. The mine lies between the middle and the south forks of the Mokelumne River. There are two veins 4 and 16 feet in width respectively. Rock in the tunnels prospects $40 per ton. Number of men employed, 8. It is reported that the mine has been sold to a San Francisco company for $150,000.

Bradley & Co. own the Whisky lode; three shafts have been sunk, the greatest depth attained being 125 feet. Vein varies from 8 inches to 3 feet in width. Rock yields an assay of $60 per ton.

The Texas mine, Davidson & McDonough proprietors, is worked through shafts. The ledge averages 2 feet thick, and the quartz will pay about $50 per ton. This is a promising mine.

The Old French lode, the property of J. Gouldson, esq., has three shafts sunk upon it, 63 feet being the greatest depth attained. The vein averages about 3 feet in width, the ore paying about $45.

The Pride of Bummerville has been sunk on to the depth of 83 feet; vein is 20 inches thick, affording rock that will yield $50 per ton; number of hands usually employed, 6.

The Henry mine is owned by Rowe & Jenkins, worked by a shaft; depth obtained, 130 feet; rock pays $35 per ton; width of vein, 30 inches.

The Star of the West, owned by Richardson & Co., is one of the best mines in the district. Shaft 300 feet in depth, developing a vein averaging about 2 feet in width. The ore pays $60 per ton. Ten men employed.

The Tucker mine is worked by a shaft to the depth of 120 feet; width of vein, 2 feet; assay of rock, $60 per ton.

The Valentine mine, owned by Ayres & Co., employs 6 men; depth of shaft, 112 feet; width of vein, 20 inches; rock yields $50 per ton.

Pride of the West, owned by Sterling & Co., is worked by both shaft and tunnel, the greatest depth reached being 75 feet. The ledge is wide, averaging 3½ feet, and pays about $35 per ton.

Blazing Star, Eberhard & Co. proprietors, is also worked by tunnel and shaft; ledge, 14 inches thick; ore averages $70 per ton.

The Bismarck is the property of Mentzel & Co.; shaft, 53 feet deep. A tunnel has also been run. The vein is about 2 feet wide; quartz averages $35 per ton.

The Scorpion is one of the leading mines in the district, Height & Co. owners. Three shafts have been sunk to the depth of 130, 100, and 52 feet, respectively, and several tunnels run. The vein varies from 20 inches to 5 feet in thickness. Rock is rich, paying as high as $90 per ton. Eleven men employed.

Other mines in this district, of which special mention need not be made, are the Josephine, Belcher, Riverside, Snowdrop, Mentzel, Tom Payne, New Wisconsin, Zacatero, and Modoc.

*Railroad Flat district.*—A large number of the promising mines of this district have been worked down to the water-level, and then for want of capital necessary to erect the requisite machinery temporarily abandoned; for this reason active operations, at present, are limited.

Among the principal mines is the Chicago; a shaft has been sunk to the depth of 250 feet, developing a vein of quartz fully 4 feet in width; the rock so far has paid an average of $22 per ton. The mine is supplied with a good 8-stamp water-power mill.

The well-known Chapman mine has also a shaft 250 feet in depth; ledge, 3½ feet thick; average yield of ore, $35 per ton. The mine is now being worked by a small force of hands, the steam-hoisting works having lately been destroyed by fire.

The Petticoat has a shaft 400 feet in depth; vein, 3½ thick; has heretofore been worked with varying success, now idle.

The Wolverine mine is one of the most famous in the district. It has been worked to the depth of 300 feet and yielded superior ore. There is an abundance of pay rock yet remaining in the mine.

The Poor Man has been worked to the depth of 250 feet. The ledge is upwards of 7 feet thick, the ore averaging $81 per foot.

The Prussian Hill is a noted mine. Depth of shaft, 250 feet; width of vein, 4 feet; ore averages about $60 per ton. The works on this mine were recently destroyed by fire.

Mines and locations of lesser note in this district are the Poe, Beede, Bald Eagle, Herzer, Lancaster, and Sundemeyer.

*Glencoe district.*—There are a large number of mines and locations in this district, mainly small ledges, of which it is only necessary to mention the more important.

The Valentine is a well-known and very valuable property. The ledge is fully 5 feet in thickness, and its location is such that it can be worked to the utmost advantage. The ore has paid an average of about $25 per ton. Two tunnels have been run on the vein 450 and 700 feet in length respectively. The mine is supplied with a first-class water-power 20-stamp mill, with rock-breaker and self-feeder attachments. Idle at present for want of water.

On the same fissure as the Valentine are a series of promising mines, all owned by the same company, which have been worked for depths varying from 150 to 400 feet. Very rich ore has been extracted, some of it yielding as high as $125 per ton. The ledges are what are termed by miners "kidney veins," alternately enlarging and contracting throughout their entire length, ranging from 6 feet to 6 inches in width. At present only six men are at work, running a tunnel, already 600 feet in length, that will "tap" the ledges at a depth of 450 feet. The names of the several mines of the series are the Woodcock, San Bruno, Dolly Varden, Mexican, and Good Hope. A fine 18-stamp steam-power mill is connected with this property.

Le Franchi, with the same general characteristics as the mines last named, has been worked to good advantage; it has yielded ore ranging from $34 to $95 per ton.

The Charlotte mine is being worked through two tunnels, 60 and 185 feet in length, respectively. Ledge averages about 30 inches; rock averages about $30 per ton.

The Blue Jay has a shaft 150 feet deep; vein 3½ feet wide; only two men at present at work.

The well-known Norwich mine is a promising property; shaft 200 feet in depth; ledge about 6 feet wide. It has produced a considerable quantity of good milling ore, ranging from $10 to $60 per ton. It is provided with excellent steam-hoisting works. At present it is in litigation.

The Fidelity mine, on the same lode as the Norwich, has been worked to the depth of 165 feet. The ledge ranges from 20 inches to 4 feet in width, the fissure being fully 7 feet wide; has yielded quite largely. The mine has steam hoisting works. At present the property is in litigation.

The San Pedro lies parallel to the San Bruno shaft, 200 feet in depth; width of vein, 4 feet.

The Alabama mine, which is on the extreme western verge of the great quartz belt of the district, is being worked by a small force of hands. Several shafts have been sunk, ranging in depth from 35 to 100 feet. The ledge averages about 4 feet thick and has yielded some very rich ore.

Other mines are the Headlock, Banner, Monte Christo, Mexico, and Glencoe.

*Rich Gulch district.*—There is comparatively but little activity in this district at present. One of the principal mines is the Tiger, owned by

C. Schlund, esq. The work done is represented by two shafts, 90 and 45 feet deep, respectively, and a tunnel 450 feet in length. Two cross-cuts, recently run, show the ledge to be 7 feet wide. The tunnel has lately been retimbered. Rock will pay from $18 to $35 per ton. Connected with the mine is a 10-stamp steam-power mill.

The Anglo Saxon mine has a shaft 150 feet deep, and levels have been run each way upon the ledge. Three men are employed. It is a promising property.

The Foot and Thompson mine, in this district, was formerly one of the most profitable in the State. Now idle for lack of capital.

*Mokelumne Hill district.*—Some of the most noted quartz mines in the State are located in this district; but at present, owing to legal complications and litigation, bullion production is at low ebb. A good deal of work is being done, but for the causes referred to operations are not of a nature to give favorable results. The possibilities for the future of the Mokelumne Hill are very flattering indeed, and when litigation ceases and men of means become interested in the working of its mines, it will rank second to no other section of the mineral belt.

One of the most promising mines, now unfortunately idle, is the Experience, better known as the Boston. It is located in Buckeye Gulch, about 2½ miles northeast of the town of Mokelumne Hill, near the Mokelumne River. A good wagon-road has been constructed to the mine. Boarding-houses and blacksmith shops have been erected and a thoroughly equipped 20-stamp mill built. The ledge is an enormous one, fully 60 feet in width, cropping boldly out of the base of a high ridge, so situated as to be easily and rapidly mined at a minimum expense. A tramway connects the mine with the mill, and so superior are the advantages for conducting operations that the entire expense of mining and milling the ore need not exceed $1.50 per ton. Two tunnels have been run longitudinally on the vein, the longest being about 360 feet in extent. The ledge has been "cross-cut," developing an inexhaustible body of quartz, containing both sulphides and free gold. As near as can be ascertained, the ore crushed yielded from $4 to $6 per ton, exclusive of the sulphides. In prospects for the future the experience is not exceeded by any mine in the mineral sections, and should, with proper management, become greatly remunerative. Sixty men are employed when the mine is in full operation.

The famous Gwin, once one of the best known and largest yielding mines on the coast, is situated in Rich Gulch, about 5 miles southwest of Mokelumne Hill. At present the Gwin is idle, pending the erection of machinery powerful enough to work it at the great depth that has been attained, 1,400 feet. As the history of the Gwin forms a goodly portion of the history of the mining archives of the State, a brief description of its principal features is appended. The mine is 1,800 feet in length by 600 feet in width, located on the great "mother" vein of the State. It was discovered in 1851, the surface rock being very rich, and was worked in a superficial, desultory sort of way until 1867, when it fell into the hands of capitalists. The new proprietors worked the mine energetically, systematically, and profitably. Shafts were sunk, mills erected, chlorination works put up, &c., improvements being constantly made until the Gwin became one of the best equipped mines on the coast. In 1871 the adjoining mine on the Alexander was purchased and consolidated with the Gwin. Three shafts have been sunk, the main one reaching a depth of 1,500 feet. Fourteen levels, varying from 300 to 700 feet in length, with accompanying "slopes," represent the underground work performed. The ledge is an average of 7 feet in thickness, the rock yielding about $6 per ton. The pay "chute" is from 500 to 700 feet long; one of the most extensive chimneys ever worked in the State. The mills aggregated 66 stamps, run by water power. The pumps were operated by steam. The sulphides worked by the chlorination process are said to have yielded an average of $100 per ton.

The Lamphear, a good mine, but one that has been sadly "mangled" by bad management, is located in Spring Gulch, 2 miles east of the Mokelumne Hill. The workings on this mine are two shafts, 170 and 130 feet in depth, respectively; a level 300 feet in length, with a few cross-cuts. The ledge averages about 5 feet in width, and is unquestionably a true vein. A great deal of ore has been mined, averaging in yield from $6 to $19.10 per ton. In the estimation of competent judges the mine is a valuable one, requiring only intelligent management to prove a remunerative property. The Lamphear has an excellent 12-stamp water-power mill, substantial hoisting works, and is supplied with one of Knight's improved pumps.

The Mokelumne mine has a shaft 214 feet in depth, showing a fine ledge 30 inches wide. Development is now being made with very flattering prospects.

Other locations in the district, of which favorable mention may be made, are the Bryan and White Swan.

*Jesus Maria district.*—The leading mine in this district is the Hoosier Consolidated, an aggregation of claims comprising 3,600 feet in length. The Hoosier is a fine property not yet fully developed, but sufficiently so to warrant the assertion that its future will be a prosperous one. Three tunnels have been run on the ledge, ranging in length from 140 to 325 feet, opening up the vein at the respective depths of 45, 138, and 248 feet. The lode averages 4 feet thick. Rock pays from $6 to $8 per ton. The ore is conveyed from the mine to the mill by means of an inclined tramway 2,000 feet in length. Ten-stamp water-power mill. Twelve men employed when in full operation.

Mount Smolus mine has a shaft 330 feet deep. Four levels have been run from 100 to 170 feet in length. Vein averages 4 feet in width. The mine is supplied with a 10-stamp steam-power mill, and steam hoisting works.

A great deal of work has been done on the Whiskey Slide and Livermore mines. The latter has a 200-foot shaft and 10-stamp mill, but is not now in operation.

*Washington district.*—The principal mine in this district, and one of the most productive in the State, is the famous Sheep Ranch, formerly known as the Wallace & Ferguson. The mine was discovered in 1867, and has been steadily worked, and with favorable results, ever since. It is now owned by Messrs. Haggin & Tevis, of San Francisco. The mine has been worked to the depth of 600 feet, and the sinking of the shaft is now progressing. Six levels have been run the full length of the pay-chute, averaging 650 feet in extent, and the ore stoped out. The vein carries from 6 inches to 5 feet in width, the rock yielding about $22 per ton. The mine is supplied with all the latest improvements for working to advantage. Burleigh drills, run with compressed air, are used in the stopes and shaft. Powerful hoisting works, pumps, and a fine 30-stamp steam-power mill comprise the machinery employed. The gross yield of the mine is estimated at $18,000 per month. Directly and indirectly, employment is given to about 100 men. The adjoining mine on the same vein, formerly known as the Chavanne, is now consolidated with and forms a part of the Sheep Ranch.

The Hearrington & Andros mine, located near Cave City, is one of the most promising in the district. The workings on the mine are represented by a tunnel, between 600 and 700 feet in length, and two shafts. The ledge, which is fully defined and lies in a true fissure, averages about 5 feet in width. A fine 20-stamp mill has been lately erected, the rock having formerly been crushed in arrastras. The mill has not been in operation long enough to estimate the yield of the rock, but will, it is believed, yield a good profit on the expense of mining and milling.

The Wheelock & Rodgers mine is worked through a cut, ledge large, averaging about 14 feet. The rock is worked in arrastras.

*Murphy's district.*—Renewed activity is observable in this district, both in developing new mines and working old ones. The outlook is favorable in the extreme.

Among the more notable mines are those owned and worked by the Oro Plata Company, an organization of which Z. Williams is president. The mines are the Oro Plata, Pay Rock, Red Wing, and White Wing, all in limestone formation. The ores are rebellious, containing silver, lead, cobalt, &c. The rock pays an average of about $20 per ton. The mines are worked through shafts, tunnels, winzes, &c.; the deepest shaft, 300 feet, being on the Oro Plata. On all of the company's mines, which lie in a group and join each other, there have been 2,000 feet of tunnels, drifts, and winzes run, and about 800 feet of shafts sunk. The company has extracted upwards of 8,000 tons of ore, a part of which still lies on the dumps of the various mines; 5,000 tons worked in the company's mill yielded about $14 per ton. The new works of the company started up during the past year. They are composed of four Tustine pulverizers, with a capacity of 10 tons each; six Frue concentrators and a classifier, the latter being the invention of Mr. Morse, the superintendent. It is the only one in operation in the State, and is said to work well, materially aiding the concentrators.

From the mill the concentrates—including the precious metals—are conveyed to the company's chlorinating and roasting works, a mile distant, which are extensive and complete.

Hydraulicking has recently been resorted to in separating the dirt from the quartz and saving the gold contained in the former. The quartz thus obtained is low grade, and in immense quantities, but cheaply mined; about 1,000 tons per week. All of the company's works are now in successful operation, and if the crushing of the low-grade ore proves remunerative the working capacity will be doubled. Both water and steam are employed as motors. The shaft started within the present year is 107 feet deep. The 100-foot level drift is 200 feet in length; the whole in quartz of high grade. The ledge shows 6 feet thick. The company employs 37 men.

The Washington mine is situated on Indian Creek, near Murphy's. This property has been worked for several years, but until recently has not been in hands controlling sufficient capital to conduct operations with system and energy. The owners are now engaged in sinking a permanent working shaft, which has already attained a depth of over 100 feet. An 8-inch pump has lately been put in which obviates the difficulty formerly experienced from water. Both the pump and hoisting works are run by water-power. There are 700 tons of ore on the dump; twelve tons of rock crushed in a custom mill paid $12 per ton. Fifteen hands are employed.

The Calaveras mine, located within a few miles of the Washington, and between it and the Oro Plata, is owned by an Oakland company. The work now in progress is running a level from the bottom of shaft, 400 feet deep. The lode shows 7 feet thick. Good rock. A Burleigh drill is used in the level, rapid progress being made. Several thousand feet of levels, shafts, tunnels, &c., have been run. A new mill is to be erected in place of the one burned. Formation, slate. Six men employed.

The O. K. and Buckhorn mines belong to the same parties. The former has two shafts 65 feet deep, levels, &c. Four hundred tons of ore worked yielded $10.50 per ton.

The Buckhorn has an 80-foot shaft and 400-foot level; 400 tons of rock paid $8 per ton.

The Collier mine is now idle, owing to complications. Over a 1,000 feet of tunnels, levels, drifts, &c., have been run, and a large quantity of rock crushed in the 5-stamp water-power mill on the mine. Rock paid about $30 per ton. Formation, slate.

The Sunnyside has been bonded to a San Francisco Company, who have a mill in process of erection. The ore from this mine is high grade, several hundred tons of which lie on the dump. Fifteen tons of rock, reduced in San Francisco, paid $100 per ton. About 600 feet of tunnels, drifts, &c., have been run. Other mines are the Central Hill and Noble, the latter having a 5-stamp mill.

*Angels district.*—This is the oldest established and also one of the richest and most productive districts in the county. Great activity has prevailed for the past two or three years. New mines have been discovered and opened, and old ones worked with increased vigor. Machinery has been erected in many places throughout the district. Nearly all of the mines of which mention is made are located on the "mother lode."

The Marshall mine, formerly known as the Bovee, is 400 feet in length by 300 feet in width. Three shafts have been sunk, the deepest being 240 feet. The vein is large, averaging about 12 feet wide; average yield of ore, about $20 per ton. The mine is now being worked by Cushing & Bovee; number of hands employed, 20.

Adjoining the Marshall on the south is the Big mine, now known as the Potter. It is 400 feet long and 300 feet wide. There have been two shafts sunk 600 and 125 feet, respectively. The vein in the 600-foot shaft, which is now being worked, ranges from 9 to 12 feet in width, and the average yield is never less than $15 per ton. From 5 to 8 men are employed. The ore is worked by arrastras, two of which are kept steadily running.

The Dock Hill mine, on the same lead, is owned by Potter & Smith. Findley & Co. are working the mine. There are three shafts, the deepest of which is 100 feet. Width of vein, from 4 to 6 feet; the ore averaging about $50 per ton. Also worked by arrastras.

The Lightner is now idle; shaft 100 feet deep. When worked yielded about $12 per ton.

The Invincible, formerly known as the Utica, has a shaft 110 feet deep; width of vein matter, 8 feet. Pays an average of $15 per ton. Six hands employed.

The Stickles mine joins the Invincible on the south; was worked by San Francisco parties. Average yield of rock, $8 per ton.

The Confidence mine, located west of the Utica, owned by the heirs of J. T. Fletcher, is 850 feet long; deepest shaft, 50 feet; width of ledge, 3½ feet. Rock pays $16 per ton. The mine is supplied with a 5-stamp mill. The Confidence is a fine property with a promising future before it.

Half a mile west of the mines last mentioned lies the famous Gold Cliff, an anomaly in the way of quartz mining. As the name indicates, the whole face of the mountain, or ridge, in which the mine is located—which is a talcose formation—is being worked. In fact, the entire hill is being put under the stamps, there being scarcely any waste water whatever. The mine is 150 feet in length by 600 feet in width, the matter worked paying about $3 per ton. There are two mills, aggregating 30 stamps, kept steadily in operation, and another battery of 20 stamps is to be added. Twenty-five men are employed.

The Lindsey is a "pocket" mine; very rich rock is taken from it. Shaft 125 feet deep.

Among the most prominent mines in the Angels district is the Porter, located on Carson Creek, 3 miles southwest of Angels Camp. It can, with propriety, be called a silver mine, as silver predominates in the ore. The shaft is 145 feet deep, and the ore-body is from 9 to 15 feet in width. Nine hands are employed.

*Carson district.*—There is great activity in and about Carson Hill, the nucleus, so to speak, of the district.

The Melones Consolidated, comprising the Reserve, Enterprise, Point Rock, and Old Melones mines, extending from the Carson to the Stanislaus River, a distance of several thousand feet, has lately been sold to a San Francisco company, which is pressing operations with vigor. A fine 40-stamp mill is just completed on the Reserve mine, 80 tons of ore being put under the stamps daily. The pay matter is of a talcose nature, and as it is from 40 to 60 feet wide, can be very cheaply mined and milled, the entire cost not exceeding $1.50 per ton. Twenty men are employed.

The Enterprise, Point Rock, and Old Melones are of the same general character as the Reserve.

Joining the Reserve on the north is the celebrated Morgan mine, owned by Irvine & Co. The company is now building a 20-stamp water-power mill on Carson Creek. The rock in this mine has been enormously rich, and it is reported that upwards of $5,000,000 have been taken out. There are two veins, one 60 feet and the other from 2 to 3 feet wide. Shafts have been sunk 150 and 200 feet. The Morgan is considered a very valuable property.

Other mines upon which work is being done with good results are the Union, Iron Rock, Vanderbilt, Chaparral Hill, Read, Virginia, and Garibaldi. The latter has a small mill, and is working rock with good results. Fifteen hands are employed.

*San Andreas district.*—There are but few mines in this district. The Gottschalk has a shaft 110 feet deep, ledge about 3 feet thick. Good judges think it a valuable mine.

Bode & Wallace.—Ledge 10 inches to 2 feet thick. A tunnel 500 feet in length has been run on the vein. Rock is now being crushed in Thorpe's mill; yields about $10 per ton. The Pioneer Chief has a shaft 300 feet deep, levels, &c.; lode from 2 to 4 feet wide; now idle.

The Donnallen and Hagerman mine, located on the Bay State ranch, is a remarkable property. It is 300 feet wide, of a talc formation, embracing five separate quartz veins. In fact, the entire 300 feet is pay matter, and is all put through the mill. The material is mined from a "face" paying an average of $8 per ton. The quantity is practically inexhaustible, and can be worked to a considerable depth without difficulty from water. Asbestos is also found. The company runs a 5-stamp mill by water-power. Other mines are the Hemby and Thorpe.

*Copperopolis district.*—This was once famous as a copper-producing district. The principal quartz mines are the Meritus and Pine Log-

The former has a tunnel 100 feet long, vein 3 feet thick, 4-stamp mill. The Pine Log has a 300-foot shaft, vein 2 feet wide, 5-stamp mill.

*Campo Seco district.*—The principal mine is the Borger, shaft 100 feet deep. Unproductive.

The Storey and Sterling are reported to have produced the past year $5,500 in gold, and the Ballard $1,200. There are also several copper mines in this district, besides deposits of iron, chrome, bituminous coal, and asbestos.

*Gravel mines.*—The gravel-mining interests of the county are only second to those of quartz. Operations are confined to deep diggings, tunnel, shaft, and hydraulic and river mining, the placers being exhausted. There are extensive deposits of gravel in this county, some of which are in a good state of development, while others, for lack of capital and the necessary water supply, are not even prospected. There is room here for both capital and enterprise in gravel mining.

Many of the principal gravel mines are in the Mokelumne Hill district, comprised within a radius of 5 miles of the town of that name. The location of a majority of them is in Chili Gulch and on Tunnel Ridge.

The Gleason gravel mine, owned by Starr & Mathison, is located in Stockton Ridge. It is worked through an incline 380 feet long, at an angle of 20°. Total length of drifts, 2,750 feet; amount of ground breasted out, 380,625 cubic feet; average number of hands employed, 21. The single-drum friction-geared hoist employed is capable of hoisting 150 car-loads per day. The 6-inch Cornish pump has a capacity of 35,000 gallons per day. There is an 8-stamp mill, capacity, 85 car-loads per day. The power for pumping, hoisting, and milling is supplied by three hurdy-gurdy water-wheels, run by 46 inches of water, under a pressure of 225 feet.

The Green Mountain tunnel claim, in Chili Gulch, owned by McSorly, Son & Co., is an extensive and profitable property. The claim, which includes 80 acres, is worked through a tunnel 1,125 feet long. The pay channel is about 500 feet wide. It is drifted from 6½ to 7 feet in height, but good gravel extends much higher. The gravel pays from $2.50 to $2.75 per car-load. Cost of extraction and milling, 80 cents per car-load; 7 hands employed; 8-stamp mill, run by water-power.

The Rough Diamond, also in Chili Gulch, is owned by Jellson & Longley. Tunnel 900 feet in length. The output of gravel is about 1,000 car-loads per month. The gravel is put through a 5-stamp-mill, and pays well.

The Empire, situated in Old Woman's Gulch, is among the more extensive mines that are being profitably worked. It contains 80 acres of patented ground. Worked through an incline 300 feet long, from the bottom of which drifts, aggregating thousands of feet in length, radiate in every direction. Ten-stamp mill and hoisting works, run by water power; 16 hands employed.

The Concentration and Hartman claims, also located in Old Woman's Gulch, worked through tunnels, are productive.

The Safe Deposit is idle. A shaft is being sunk on the Three Ball mine.

Other tunnel and shaft claims are the McCain & Cummings, Sullivan, Boucher & Brackett, Bob Paul, What Cheer, Heughes, Heoges Gulch, Calaveras, Concentrator, &c.

The Eureka, owned by the Cook Brothers, situated near the Calaveras River, is the principal hydraulic mine. There are 20 miles of ditches connected with and belonging to the mine, conveying 1,000 inches of water, which is used under a heavy pressure. Operations are continuous, with the exception of a month or two during an occasionally more than ordinarily dry year. The product of the mine varies from $30,000 to $60,000 per year.

The Bonanza, on Tunnel Ridge, the Mammoth, Penobscot, Georgia, Buchey, and Pine Park, are hydraulics, using from 200 to 400 inches of water, and are energetically and profitably worked, yielding from $15,000 to $30,000 annually.

In *Poor Man's Gulch* is the Kramer mine. A tunnel 15,000 feet long runs through a solid bed-rock. Gravel not yet reached.

In *Railroad Flat district* there is an area of about 2 miles square of deep gravel deposit of average thickness. In places the gravel is covered with a stratum of lava, ranging from 15 to 50 feet in thickness. Under the lava formation the gravel is very rich, frequently paying as high as 50 cents to the pan. The deposit can be successfully worked by hydraulic and drifting. An important discovery has recently been made. Mr. M. V. Clark and the Larische Brothers, owning adjoining claims, have found the great "blue lode," so successfully worked in the northern counties. The gold is coarse, of fine quality, and has the appearance of channel gold. This old channel lies at the base of the lava ridge, 300 feet high. Preparations are being made for working this deposit on a large scale. Capital is required and can be profitably employed. The principal mines in this district, now in operation, are the Clark & Woodbury hydraulics. These mines are worked on an extensive scale, and are very productive.

In the *Cave City district* are several hydraulics, the principal one being the Table Mountain and San Andreas Water Company's claim at Guston Hill. They use 400 inches of water under a pressure of 114 feet. Are productive.

The Riley claim has a tunnel several hundred feet in length to tap "limestone range." Has been worked four years with profit. Cunes & Co. use 250 inches of water under a pressure of 100 feet. Pays well.

At Dogtown are some very extensive gravel mines. Chief among them is the Jupiter, deep-blue gravel, principally owned by W. A. Keifer.

The Jupiter is composed of three claims, the Railroad, Bully Bully, and Buckeye. Thousands of feet of tunnels and shafts have been run and sunk in getting this mine in shape for hydraulicking; 1,500 inches of water are used under a pressure of 150 feet. Fifteen hands are employed. This mine has yielded a large amount of money.

Monarch gravel mine has a tunnel 900 feet in length. A shaft 160 feet deep is also used. Number of men employed, 16. This mine has yielded $120,000. Other mines are the Lundt, Jack Rabbit, and Amazon.

At Bald Hill near Altuville is the well-known McElroy claim, worked through a shaft 200 feet deep. Productive. Also the Lee claim; shaft 85 feet deep; is paying well.

At Vallecito and Douglas Flat but little is doing. The Mitchell claim at Vallecito is a valuable property, but the great amount of capital necessary to develop it causes the mine to remain in idleness.

At Douglas the Old Judge is about the only mine of prominence working at present.

Near San Andreas work has been resumed on the San Andreas Gravel Mining Company's claim with good prospects; worked by shaft; steam hoisting works.

In the *Comanche district* nearly all the claims are idle for lack of water. Storey & Sterling's claim, the principal one, has a tunnel 1,200 feet in length, employs 20 men, and has for years been a paying claim. It is reported as having produced during the past year $5,500.

There are on Sand Hill five hydraulic mines now idle for want of water. They are, however, all profitable when running.

Most of the surface mining has been discontinued; also river mining, as the river beds have too much gravel in them to be moved before the bottom is reached. Reliable information is hard to get.

The Calaveras Water and Mining Company's claim, in the vicinity of Jenny Lind, is one of the most extensive gravel mines in the State. The company owns a square mile of mining ground, 21 miles of ditches, extensive reservoirs, &c. Owing to legal complications operations have been of late somewhat retarded. Thirty hands are employed when the mine is in full operation.

In *Copperopolis district* the principal gravel mines are the Alta, worked through tunnels, and the Regarré and the Pierre river claims.

In the *Central Hill district* are the Rising Star, Merrimac, Armstrong & Harkins and Jackson claims, worked through tunnels and shafts. These mines have all paid well.

The Worth's Hill is a hydraulic mine operated by Chinamen, and is productive.

## DEL NORTE COUNTY.

This is the extreme northerly county of the State, it being bounded on the north by Oregon, east by Siskiyou County, south by Humboldt County, and west by the Pacific Ocean. The mining portion of the county is chiefly on the eastern side, on the Klamath River, next to Siskiyou and Humboldt County lines, although the coast side has some good mining ground.

The Klamath River is the main auriferous stream. This river cuts through the county, and very nearly forms its eastern and southern boundary.

Gold mining in this county has been steadily and successfully pursued since 1851. The placer diggings on the Klamath and Smith Rivers, the black sand on the ocean beach, and more especially the extensive hydraulic mining carried on in the region of Happy Camp, all demonstrate everywhere in this section the presence of gold in paying quantities. Happy Camp is the only section of the county that has received any benefit from capital. A large amount of money has been invested in mines at Happy Camp, which are now being worked at a profit. Besides the mines at Happy Camp there are various river-bar claims, worked and owned principally by Chinamen. There are also quite a number of mines scattered around in various parts of the county now lying idle, which only need capital to make them paying properties.

The class of operations carried on now on the Klamath River are confined chiefly to large hydraulic companies, although during the summer and fall months considerable wing-damming is done. This latter class of operations is generally conducted by individuals or small companies, and work can only be successfully carried on after the waters have receded to the summer stage, and has to be suspended at the first rise. Still another class of operations carried on on this river is known as "bar mining." This is generally carried on where the mine has ground that can be commanded by the waters of an adjacent creek and a tributary to the main river. There are quite a number of this class scattered along the Klamath from Happy Camp to Klamath Bluffs, a distance of 100 miles. Amongst the best paying ground of this class may be mentioned the claims Robert Elliott at Cottage Grove, Aubrey and Edward Stanshear near Orleans Bar.

Commencing on the upper river, at the northerly and easterly boundary of the county, the chief hydraulic claims are as follows:

China Creek, owned and worked by Mr. Joseph Reeves. He has carried on operations here for ten or twelve years and has a fine property.

About 3 miles below, J. A. Evans has some very good ground, which he works successfully each year.

A few miles lower down the river comes the large hydraulic claim, owned by S. S. Richardson, and known as the Del Norte Hydraulic. The water is brought onto this claim from Elk Creek, a tributary of the Klamath, by a ditch about 9 miles in length. It has capacity for two pipes, and employs 25 or 30 men during the water season. Mr. Richardson has worked this claim for about thirteen years, and it is counted one of the best properties in this section of the county.

Muck-a-Muck, owned by A. Doolittle, is also a remunerative property.

The Happy Camp Hydraulic, immediately below the town of Happy Camp, is owned by Horace Gasguet, who leases it to a party of miners. The water is brought to this claim through a 17-mile ditch.

Clear Creek and Wingate Bar are classed as good claims, and have been worked for many years successfully.

The Bunker Hill claim, owned by Temple & Chiles, consists of a series of gravel benches, with a dump into the river. This is one of the oldest hydraulic claims in California, it having been worked for twenty-six years. They employ a good force of men the year round. Water is brought onto the claim from Independence Lake, a distance of 22 miles. All these claims appear to have done much work during the past year, and have made many improvements.

The last water season was claimed as a good one, and their success this year will be the cause of opening up considerable new ground another season.

On what is known as the coast side of the county, and situated on Smith River, which furnishes the dump, are situated several large hydraulic claims.

The Big Flat Gravel is situated on Big Flat, on Smith River, from which it takes its name. The property is owned by Messrs. Lane and Paris, and they have recently purchased and consolidated with their property the ground and water rights of the Mountaineer Company. The property consists of a series of gravel benches, containing from twelve to fifteen hundred acres, and water is brought through an 11-mile ditch. They have an enormous pressure and an excellent dump. During the past season they ran the mine day and night, and the product is said to have exceeded their most sanguine expectations. This company expended over $200,000 in bringing water to this ground.

The Armand is also a hydraulic claim, located on Haynes's Flat, and has an extensive range of gravel which prospects well, though no work has been done on the claim for several years, owing to protracted litigation.

The French Hill Hydraulic, situated on the hill from which it takes its name, has a large gravel deposit and a fine water privilege. It has been worked in a small way for a number of years, but has recently passed into the hands of a New York capitalist, who is making preparations to work it on a much larger scale.

The Del Norte quartz mine is the only quartz mine in the county now worked. Their operations are at present confined to prospecting, and they have taken out some very rich rock.

*Point Lookout*, an old mining locality, was worked for several years with varying success by many parties.

*Indian Flat*, another old mining locality, is situated on the other side of the Klamath, and almost directly opposite Point Lookout. Between it and Muck-a-Muck Flat, a distance of 6 miles, is a continuous range of gold-bearing deposits, extending at some points several miles back from the river. Various places on the different forks of Indian Creek, long since abandoned by those who had to depend upon hard manual labor to wrest the gold from its primitive condition in cement and hard rock, can be made to pay well by the use of improved machinery and under the supervision of good, practical miners.

There are several ledges of silver-bearing quartz in the county. In fact, nearly all the gold-bearing quartz contains some silver, and the copper and chrome ores contain more or less.

There are also well-defined and extensive copper leads in this county, which in years past were worked with good results, but owing to the decline in value for copper they were suspended and have never since been resumed. All the ore taken out carried a large per cent. of silver.

## EL DORADO COUNTY.

El Dorado is one of the large mining counties of the State, having an area of 2,220,000 acres, and was in 1849 called the "empire" mining county of the State. It was at Coloma, in this county, that Marshall, while employed by Captain Sutter in digging a mill-race for a mill on the American River, picked up the first piece, or nugget, of gold. This fact, which was soon heralded to the world, caused the Argonauts to flock to the Pacific coast by land and by sea, and El Dorado was the first county that became thickly populated by the gold-hunters of early days.

El Dorado is essentially a mining county, although agriculture and fruit-raising are carried on quite extensively in the western portion of the county, while the eastern portion is mining. Another valuable interest in the eastern portion of the county is its vast forests of valuable pine timber.

On what is known as the Georgetown divide, lying between the South and Middle Forks of the American River, extending from a point on the west, where these two tributaries of the American River come together, a short distance above Folsom, in Sacramento County, can be seen some of the finest timber in the State, still standing in all its pristine grandeur. From a point about 10 miles up the ridge from Georgetown this belt of timber extends nearly 30 miles, and from the Middle Fork of the American River to the South Fork, a width of about 20 miles, showing an area of 450,000 to 500,000 acres covered with fine pine, spruce, fir, and oak timber. These trees are large and fine, being from 200 to 250 feet in height and from 3 to 9 feet in diameter.

The county is well supplied with water by a system of ditches and canals, the water from which is used both for irrigation and mining.

The mining industry of the county has not been as profitable during the past year as in years past. Still a good many of the mines are in operation and many of the quartz mills are pounding out their usual amount of the precious metals.

*Grizzly Flat.*—At this place is the Mount Pleasant mine, the most productive mine in the county at present. This mine was worked as early as 1852 and paid to a considerable depth, but owing to the inexperience in quartz mining at that time and bad management it was abandoned for a time. Of late years, however, with all the improvements in quartz mining now at hand, with cheap water-power to crush the rock, with self-feeders at the mill, with concentrators and chlorination works to save the sulphates, the Mount Pleasant is really a first-class property and is yielding large returns. The 20-stamp mill, which is kept constantly in operation, is supplied with all the latest improvements and does its work in an economical manner.

Mr. I. H. Smith, superintendent of the Mount Pleasant mine, reports that a shaft of 500 feet has been sunk, and by the first of March will be down 600 feet. The vein increases in size as a greater depth is reached and retains about the same amount of gold on an average. There is no waste ore. All goes through the mill. The longest drift from the shaft is the 400-level, 954 feet. Drifts are still being run north and south. All other mines in the district are shut down for the winter, except the Milton. They are not running their mill but are opening up their mine which produced considerable gold in the past year, but I do not know how much.

The Mount Hope produced considerable, also. They will resume work in the spring.

The Baltic, a new mine, erected a 5-stamp mill last fall, and will start it in the spring. It bids fair to be a good mine.

The Day mine is being opened.

The Eagle mine, joining the Mount Pleasant on the north, which has been lying idle for a good many years, has been bonded by a Boston company for $80,000.

The Ohio mine, on the south of Mount Pleasant, will also start up in the spring. The Eagle and Ohio both will turn out to be as good as the Mount Pleasant when they are properly opened. The prospect for this district for the coming year looks well.

The Milton mine, at this place, was worked over twenty years ago by Dr. Irvine, but at a depth of 50 feet water was encountered and work suspended. The mine is being worked by some eastern capitalists, and is developing finely. The ledge, which shows a width of 5 feet, has constantly widened as depth has been attained, and shows free gold as well as being rich in sulphurets. The mine is under the superintendency of H. H. McClellan.

The Crystal mine, at this place, is being vigorously worked, mostly in prospecting. A lateral drift is being run to prospect a large ledge called the Creole ledge, the croppings of which were discovered some time ago. The main tunnel, which was commenced several years ago, is being pushed into the hill. The tunnel will cost a large amount of money, and will open up the ledges several hundred feet below the surface. This mine has a promising future.

*Georgetown.*—The Eureka mine has opened up a fine body of ore. The company has erected a 20-stamp mill, with all modern improvements. Mr. H. L. Robinson, of Placerville, says of this mine that it is located in the limits of Georgetown. The shaft is down 200 feet, with a wide ledge looking well in gold and contains much sulphurets. A contract was given to H. S. Morey, of Placerville, to build a 10-stamp mill, which will be ready to run about the 1st of January, 1884. The Taska pulverizer has been on trial this summer and has been condemned. It is of no practical use. It has been faithfully tried, and when one difficulty could be overcome others would follow. The balls wore uneven, and too much time was wasted in opening and closing the mill for changing the ball and tightening the same. Screens broke too often. Hoisting is done by steam-power, and the mill is run by water-power.

The Rosencrans, at this place, has a 10-stamp mill steadily at work, and is a paying mine. Mr. Robinson states that the Rosencrans is situated 1½ miles from Garden Valley, 3 miles southeast from Greenwood, and 3½ miles southwest from Georgetown, and embracing 1,577 feet in length by 600 feet in width. A shaft has been sunk to a depth of 200 feet and levels have been run 400 feet in length. Ledges are from 3 to 6 feet in width, and all the quartz that came out of the mine paid from $15 to $20 per ton, some exceedingly rich rock being taken out of the shaft while sinking this summer, and when the levels and stopes are open on this rock this mine will be one of the best-paying properties in the county. Hoisting and milling are done by steam-power. It is considered that the hoisting works are about the best in the county. In July a large duplex "National" air-compressor was put up and has a capacity to run 8 drills. All the drilling is done by the National drills, and the work is done satisfactorily. He also reports that the Taylor mine is the northern extension of the Rosencrans, and that it measures 1,200 feet in length and has a shaft sunk to a depth of 500 feet and good quartz in the bottom. This mine has been idle for some time, and is in the hands of men in San Francisco who have refused several offers for the property. This mine paid well when it was in operation.

Green Mountain is a gravel mine near Placerville, and is owned by Captain Ames. This mine has been worked on a small scale for a number of years, but the mine has improved and the work has been increased. A new 10-stamp mill was put up this fall and run by water-power. This mine joins the Cedar Spring on the southwest. Alderson's mine joins the Cedar Spring on the north. This mine was improved last summer by running tunnels and erecting a 10-stamp mill. They have a channel, and the gravel is looking well. The mill is run by water-power.

The Coffin & Reed is a drift mine that has been working for a number of years, and has paid well. They wash their gravel by sluicing.

The Gignac has been worked as a drift mine, but is now worked by the hydraulic system. The "bank is clean" and the mine paying well.

Benfeldt is also a drift mine, situated near Smith's Flat, and joins the Lyon mine on the southwest. It is worked through an incline 700 feet long and on an angle of 15°. This mine is and has been paying well for several years. A 10-stamp mill is connected with the mine, and the hoisting is done by water-power.

The Hook and Ladder is a drift mine, and joins the Benfeldt on the northeast and the Lyon on the west. It has a shaft 115 feet deep, good hoisting works, and a new 10-stamp mill. This mine has been idle for some time. The work was abandoned on account of the bed-rock and gravel pitching westward, and the tunnels ran out of grade so that it was not practical to work the mine. It is owned by Robinson & Anderson. Robinson, when he owned the Lyon mine, proposed to drive tunnels to the east end of the mine and work the Hook and Ladder through the same, for in this way of working it would be much cheaper and more practical.

Modden is a little further east, and is owned by a Saint Louis company. It was purchased for a hydraulic mine, but the company soon found that it would make a better drift mine, on account of the lava cap and gravel laying on the bed-rock. A man with a pick and shovel can take the gravel out much faster than he can with a "giant" under a big pressure of water. The last run the company made the gold ran very fine and was worth $20.26 to the ounce.

The Blair mine is on the same ridge, above Blakeley's. Fine hoisting works were erected last summer by H. S. Morey, of Placerville. An incline has been sunk at an angle of 30° and down 420 feet. The mine has been opened in good shape to take the gravel out. The owners will soon erect a mill.

The Parson, Pacific, and Josephine mines are also located here.

At *Greenwood* the Chapman placer claim is being worked and considerable coarse gold taken out.

The Rip Van Winkle, at Slate Mountain, southeast of Georgetown, owned by Jordan & Zambro, has been bonded by M. Monkton, of San Francisco, for six months for $16,000. The mine is now being prospected.

The Hanson mine, with a 10-stamp mill, has been successfully worked for the past fifteen years, and paid well.

The Alhambra mine has a small soft vein of decomposed quartz, from which $12,000 have been taken by hand mortars during the past year. The Morell Consolidated Mining Company are running a tunnel to cut the rich chute of ore 50 feet below their present level. A shaft was sunk in the ledge at a depth of 40 feet, from which some $15,000 or $20,000 of rich ore was taken. It was from this mine that a specimen of gold quartz was taken 18 inches square, which sold for $6,400, and is now on exhibition in the Academy of Sciences in Paris. Zentgraff has run a tunnel in on the ledge of his property showing ore of high grade.

*White Oak Township.*—The Hanilla mine has been thoroughly overhauled, a new mill erected, and is turning out bullion, with good outlook for the future.

The Church Union mine, now called the Springfield, has recently been purchased by Messrs. Hayward & Hobant, who are old experienced quartz miners and men of energy and capital. They have erected new hoisting works, built a 20-stamp mill, and opened up a fine body of ore, all of which go to make one of the best mines in the county. They have also purchased a ditch and water-supply for the mill and mine.

The Pleasant Valley mine, at Diamond Springs, is a good paying property and its 10-stamp mill is kept constantly in operation crushing rock from the mine.

The Grand Victory mine is also located at this place. This mine is really an anomaly, going to show what can be done with low-grade ore when the proper appliances are had for mining and milling the ores cheaply. The rock is taken from an open cut and delivered to the mill at an expense of 25 cents per ton and crushed in a 50-stamp water-power mill, supplied with all the modern improvements for working ores cheaply at an expense of 40 cents per ton, making the total cost of mining and milling 65 cents per ton. One hundred and twenty-five tons are crushed in twenty-four hours, yielding $2 per ton. The mill has been running fifty-three months without cessation, and the mine shows rock enough to keep it running for several years.

Mr. C. A. D. Gray, superintendent of the Grand Victory mine, reports that it is situated in Diamond Springs Mining district and about 5 miles from Placerville. The mine was discovered as long back as 1857. In that year a shaft was sunk to a depth of 40 feet, when hard rock was encountered in the bottom of the shaft, which caused the original locators to abandon the work. The mine remained idle until the year 1867, when a new shaft 100 feet southwest of the first shaft was sunk to a depth of 34 feet, at which point work was again discontinued until the summer of 1879, since which time the mine has been in active operation.

The present company ran an open cut into the hill and exposed a huge body of ore, the deposit on the summit of the hill being very neary 300 feet across. The ore-body stands nearly perpendicular, dipping slightly to the east, and incased in a slate formation. The mine is worked by open cuts, or the rock is quarried out. Several tunnels have been run into the hill to ascertain the extent of the ore-body; the lowest of these tunnels taps the ledge at a depth of 200 feet from the surface. The ore-body in this tunnel has been cross-cut to the extent of 200 feet, and how much wider the ore-body may be at this point is at present unknown. The ore in sight in the main working tunnel is sufficient to keep the mill running many years. The mine has produced in bullion since the mill started the sum of $150,000. The ore-body is low grade, but owing to the many natural advantages possessed by the mine, very low-grade ore can be worked at a good profit. A first-class 50-stamp mill was placed in the mines in the spring of 1881, and is presumed to be equal to any mill in California for either work or appearance, and is also supplied with all modern labor-saving appliances. Two No. 1 Dodge rock-breakers are used in the mill, and 10 Hendy automatic ore-feeders, the above machines dispensing with a large amount of labor. The ore at present is being worked only for free gold. The sulphurets are small in percentage, but high in value, and no doubt as depth in the mine is attained will increase in quantity. The mill is run by water-power purchased from the Park Canal and Mining Company, limited. A 13¼-inch Leffel turbine water-wheel in a globe case is used to propel the machinery under a head of 108 feet. The stamps weigh 750 pounds each, and strike 85 blows per minute. The cost of milling the ore is said to be only 40 cents per ton, but this is probably too low. The cost of mining and delivering of ore to rock-breakers at the mill is 25 cents per ton. The above figures will go to show that where water is obtainable under a reasonable pressure a a large body of ore can without hoisting or pumping water be worked at a profit, if it be gold-bearing, and the business therewith be managed in an economic way.

At Shingle Springs are located the Hoax, Whidden, and Sailor Jack mines, all of which are producing small amounts of bullion.

The Nashville mine, at Nashville, recently purchased by Joshua Hendy, esq., is being opened, and promises to be a valuable mine. The shaft has reached a depth of 520 feet. From a drift running south he has opened up a 7-foot ledge of fine ore, which seems to be widening as distance is made from the shaft.

The Lone Star, Cumberland, and Starlight are located at this place, and are all being developed in a thorough, systematic manner, and with good prospects.

The quartz mines at Clarksville, being the McHenry & Grey, Plunket, and Berry, are all being prospected and producing some bullion.

At Rich Gulch, near Georgetown, Armstrong & Roberts are working their gravel claim with cross-drifts about 300 feet on the main channel, and are taking out gravel that pays from $3 to $7 per day to the hand. They have 650 feet in length of this channel in their ground.

The old Independence mine, near Brownsville, that produced well in early days, and was only worked to a depth of 80 feet from the surface, has recently been purchased by an Eastern company.

At Volcanoville Mr. R. G. Hunt is opening up the Flora drift gravel, and has a large force of men at work, with fine prospects for the future.

At Prospect Flat, near Placerville, the Cedar Spring Gold Cement Company are still at work. The cement taken from the mine is of a reddish hue and contains some streaks of sand. This mine has been worked for sixteen years, and now has between 4,000 and 5,000 feet of tunnels and drifts. There is still a piece of virgin ground of 700 feet width and from 600 to 800 feet in length to be opened.

The El Dorado Deep Gravel Mining Company still continue to drift and work their claim. The Green Mountain Tunnel Company have completed a 10-stamp mill and expect to soon be in successful operation.

The Elf Company have also completed a 10-stamp mill and commenced operations with good results. The mine is on the same gravel belt as the Cedar Spring mine.

The Oak gravel mine, near Placerville, which has been worked for the past fifteen years, recently ran into a level of blue gravel, 7 feet in thickness, which shows well. They have a 10-stamp gravel-cement mill run by steam-power.

The Park Canal Gravel Mining Company are prospecting their gravel beds with good results and fine prospects for the future.

The Patterson mine, at Coloma, is being opened up and producing bullion.

At Smith's Flat, east of Placerville, is located the Gold Hill mine, owned by Osborn & Son. The mine, which is on a hillside, is opened by a tunnel commencing at the north end of the hill and running south about 200 feet. Rich deposits have been found at intervals nearly the entire length of the tunnel. About 150 feet from the mouth of the tunnel they have stoped through to the surface, where a rich deposit of gold was found, which yielded $1,300 for two days' work by washing in pans.

At Sportman's Hall, some 12 miles east of Placerville, Blair Brothers have sunk a shaft, expecting to strike the bed of an ancient river. They sunk 300 feet and came upon the bed-rock without finding the supposed channel. They are now engaged in drifting in different directions in hopes of finding it.

There is but little shallow placer mining done in El Dorado at present, except what is being done by Chinamen, who produced about $100,000 the past year.

## FRESNO COUNTY.

Fresno County, in the southern portion, is one of the largest counties in the State. It lies in the great San Joaquin Valley, its western boundary being in the Coast Range of mountains, and its eastern far up in the Sierra Nevadas. Its location is also in what is known as the dry belt of the State, where the rainfall is insufficient to mature crops in most of our dry years. But by the potent influences of water, which has been brought from the rivers coming down from the mountains, this county is fast assuming an important position in agriculture and horticulture. The soil in the valley is very fertile, and any kind of grain or tropical fruits can be successfully grown if properly irrigated.

This county has never been looked upon as a mining county, and it is only within the last two years that attention has been turned in that direction. From a small beginning this industry has increased more than fourfold during the past year. During 1883 many discoveries were made, some of which have already proven to be of great extent and value.

The Abbie mine is situated 12 miles northeast from Millerton, the former county seat of Fresno County, on what is known as Fine Gold Gulch. The mine is owned by Robertson & Morrow, of Fresno City, and is opened by an incline to the depth of 150 feet. The ore is free milling, with a small percentage of sulphurets, and yields an average of $40 per ton. The vein is in granite.

The Hildreth mine, situated near the Abbie, is in the same formation, and has the same trend, with a dip of 45° northeast. It is opened by two shafts to a depth of 150 feet. The shafts are 100 feet apart and are connected on several levels. The yield by mill process averages $70 per ton in free gold, and carries, besides, over 5 per cent. of sulphurets, which assay $1,200 per ton. The ore is reduced in a Huntington mill on the mine, which has a capacity of 16 tons per day. The ore on the lower levels is constantly improving as greater depth is attained.

In this vicinity is located the Stockton mine. This mine is opened to a depth of 125 feet by shaft, and numerous levels run. New pumping works and mill have been erected. Vein is in granite, with well-defined walls, and varies in thickness from 1 to 2½ feet. The ore for the past year has been worked in arrastras, and has yielded $40 per ton.

The Hampton quartz mine, situated at the point of junction of the north, east, and south branches of Fine Gold, 16 miles from Millerton, on the west bank of the stream, has been worked for about seven years. The ore yields about $30 per ton, and carries 10 per cent. in sulphurets, assaying $600 per ton. The ore has been worked principally by arrastra process. The vein of this mine is also in granite formation, and has a dip of about 30° northeast.

Mountain View mine, situated on the south side of main Fine Gold, 1 mile south of the Hampton mine, is in a slate formation, capped with granite. It is opened by two tunnels, in a distance of 300 feet. Ore has been worked by arrastras and yielded $20 per ton. The mine is closed down at present owing to litigation as to ownership. This mine has produced considerable bullion, and will again do so as soon as work is resumed.

Last Chance.—This mine is equipped with a fine 10-stamp steam-power mill and two Hendy concentrators. It is situated 2 miles northwesterly from the Hampton, on the North Fork of Fine Gold. The mine has been opened by several shafts and two tunnels. The main tunnel has been driven in and along the vein a distance of 400 feet, showing a fine body of ore, varying in width from 2 to 6 feet, carrying an average of $15 per ton in free gold, and about 7 per cent. of sulphurets, assaying $650 per ton. The output of bullion for 1883 was very good, although none of the sulphurets have yet been reduced, as the concentrators have only been in place a very short time. The vein is in slate formation with a heavy cap of granite.

The Texas Flat mine, situated 4 miles west from Last Chance mine, on Coarse Gold Gulch, is owned by a local corporation. The mine is opened by several shafts, the main one being 240 feet in depth, and several levels. The ore mills $20 in free gold, and carries 2 per cent. of sulphurets, assaying $350 per ton. Vein from 2 to 7 feet thick; formation, slate. A good 5-stamp steam-power mill is attached to the mine.

The Deadwood mine is situated on a stream of that name, 1½ miles east of Texas Flat mine. The mine is owned by Dodds Brothers, and is opened by a shaft and tunnel connected at the depth of 70 feet. Thirty tons have been worked in arrastras, which yielded $27 per ton.

The Hawkeye mine is situated on Sweede Gulch, about 1 mile from the Deadwood mine. This mine is in a talcose-slate formation, with a dip of 45° east. Vein, from 2 to 8 feet thick, yields an average of $25 per ton in free gold. There is a substantial 5-stamp mill on the property, but the failure of the water supply last summer caused it to be shut down. Large quantities of ore are on the dump awaiting a supply of water to mill it.

Fresno Enterprise is situated on northern side of Potter Ridge, 6 miles west of the town of Fresno Flats. It is owned by an incorporation known as the Fresno Enterprise Mining Company. This is the representative mine of Fresno County. It has been operated upon quite an extensive scale for the past four years. The reduction works consist of a fine 10-stamp mill, thoroughly equipped with all modern improvements for saving gold—four Frue concentrators being in place—and apparatus for heating water used in the batteries. Water, however, is used for propelling all the machinery. The mine was shut down during a great portion of last summer, owing to a struggle among the stockholders for control of the mine. The output of bullion was small compared to that of former years.

The Ames mine, now known as the Esperson mine, is owned by Clark & Co., of Stockton, Cal. It is situated one mile east of the Enterprise, and is opened by shaft to a depth of 80 feet. Formation, slate; vein about 12 inches in thickness, and ore works about $72 per ton.

Lucky Bill is situated on Potter Ridge, 2½ miles east from the Fresno Enterprise mine. It is opened by a tunnel, and a drift has been run on the vein 120 feet, and is known as a kidney mine, the vein varying abruptly from a few inches to 4 feet in thickness. The bulges or kidneys contain very rich ore, while but very little gold is contained in the small strata connecting the kidneys. The ore mills about $62 per ton. The mine is owned by Baker & Co.

King's Gulch mine, formerly known as the Hamilton, is situated at the head of King's Gulch, at the base of Indian Peak, 3½ miles west of the Fresno Enterprise. The mine is opened by two shafts, 50 feet apart. One on the foot wall is down to a depth of 70 feet, while the main shaft on the hanging wall is down to a depth of 100 feet. On the 50-foot level of the latter a drift was run north along the hanging wall 75 feet, and a cross-cut at that point showed the vein to be 32 feet thick from wall to wall, having seams of talc running through the quartz at short intervals. A cross-cut at the bottom or 100-foot level showed the vein to be 30 feet thick of solid quartz. One hundred and twenty-five tons of ore, consisting of the entire mass of vein matter, averaged $5.25 per ton. Machinery is on the ground for the erection of a water-power mill on the Fresno River, 1 mile from the mine. The gold is very fine, and has to be worked very carefully to save it. This is the largest body of quartz carrying gold throughout ever found in this county. The formation is a soft talcose slate. The quartz is easily mined, no blasting being required.

Surprise mine, situated in Grub Gulch, 1 mile south of the Hamilton or King's Gulch mine, is owned by the McDonald Bros., of Grub Gulch. The mine is opened by two shafts 100 feet apart, and connected by several levels. The main shaft is down 160 feet, at which point the walls are 8 feet apart, and the ore averages 3 feet in thickness, the balance of the space being filled with ledge matter slightly impregnated with gold sulphurets. The rock yields $5 per ton in free gold, and 4½ per cent. of sulphurets assaying $6 per ton. The mine has a 5-stamp mill equipped with one Frue and one Triumph concentrator. The mill is steam-power. The water-supply is obtained from King's Gulch, and is pumped over a dividing ridge which reackes an altitude of 480 feet. Above the source of supply the pipe is 3½ inches in diameter, and is 7,600 feet from the pump to the mill. The mine is in slate formation with a granite cap, and is close to the contact line between the granite and slate formations.

The Lafayette mine is situated 1 mile south of the Surprise mine, and is owned by H. V. Parker and others. The mine is opened to a depth of 125 feet, and the vein shows about 18 inches in thickness. The ore averages in the mill $12 per ton, and carries a small percentage of sulphurets of unknown value. A small Redstone mill is on the mine with a capacity of 6 tons per day.

Spangled Gold mine is situated in Spangled Gold Gulch, 4 miles south of the Lafayette mine. It is opened by a tunnel 250 feet into the mountain, following the vein, which varies from 10 inches to 2 feet in thickness. Sixty tons of ore averaged $28 per ton by mill process.

The Butterfly mine is situated on the south side of *French Gulch*, 4 miles south of the Fresno Enterprise mine. This mine fronts on Fresno River, and is opened by four tunnels run in on the ledge 50 feet apart one above the other. The vein varies from 6 inches to 2 feet in thickness, and the ore yields $30 per ton. Very little work has been done during the past year.

Wyatt & Doak mine is situated near the head of Big Dry Creek, about 25 miles east of Fresno City. The mine is opened by a number of shafts and tunnels to a depth of 200 feet. It is in slate formation, the vein averaging about 3 feet in thickness. The ore works about $7 per ton, and is worked in the company's 10-stamp water-power mill. The mine was vigorously worked in the early part of 1883, but is now shut down, owing to litigation.

There are a great number of small claims scattered through the mineral belt of Fresno County, worked by individuals, who crush the ore in arrastras and dispose of their bullion to small traders, so that it is impossible to approximate with any degree of certainty the amount of gold taken out by them, although in the aggregate it amounts to a considerable sum annually. There are also some Chinamen scattered around, reworking the old placers, but a reasonable estimate of their production is $25,000.

In addition to the above, mention may be made of the discovery of a remarkable lode of gold and silver bearing quartz near the summit of the Sierras in this county. At the time of its discovery it was stated that the ledge was 200 feet wide and 3 miles long. Recently Professor Beck, of New York, who was the discoverer, in company with several gentlemen of Fresno, started for the purpose of making a more thorough investigation of the find. Upon their return a most marvelous report was made. Instead of a ledge 300 feet wide they report it nothing less than a mountain of gold and silver. Mr. Pearce, one of the party, who has been mining for thirty years, says he never saw anything to approach it in richness. He describes it as being the center of an extinct volcano. It has an altitude of about 1,300 feet above the level of the sea, and shows a mass of gold and silver bearing quartz 1,000 feet thick and 1,500 feet above the surrounding valley.

## HUMBOLDT COUNTY.

This county is situated in the northern portion of the State, bordering on the Pacific Ocean, and with a longer stretch of sea-coast than any other county in the State. No very large amount of mining has ever been done in this county, but there has been a steady annual production of about $100,000.

The largest gold-producing mines in the county are what are known as the Gold Bluff mines, on the ocean beach at Trinidad. The gold is obtained from the sand on the ocean beach washed up by the action of the sea, which comes rolling in with great force, and then retires, when the men rush down with shovels and sacks and bring up what can be gathered before the next rush of water comes. The sand is washed in sluices. The gold is exceedingly fine, much finer than the sand with which it is mixed. For saving the gold only copper plates are used in the sluices, which are run with a light haul of water.

The next important place in the county as a mining center is *Orleans Bar.* The Savarom Bar Hydraulic Mining Company at this place has been in operation for about thirty years, and has produced a large amount of gold. The claim comprises a large amount of good rich gravel, but it is out of "grade," consequently its future prospects are not very bright.

The Pearch mine at this place is another hydraulic mine which has been in operation for several years, and is still in operation.

Markuson & Knudson are still operating their hydraulic mine with fair results.

At this place are also the following mines: French Bar, Red Cap Bar, Saint's Rest, and Big Bar, all of which have been in operation, and producing well the first season.

*China Flat* is another small mining camp, with but a few small producing mines. The Raccoon Bar hydraulic mine at this place has been worked about four years, with an increased production every year, and with better prospects for the future.

The Thompson Bar placer mine has been in operation and took out about its usual amount.

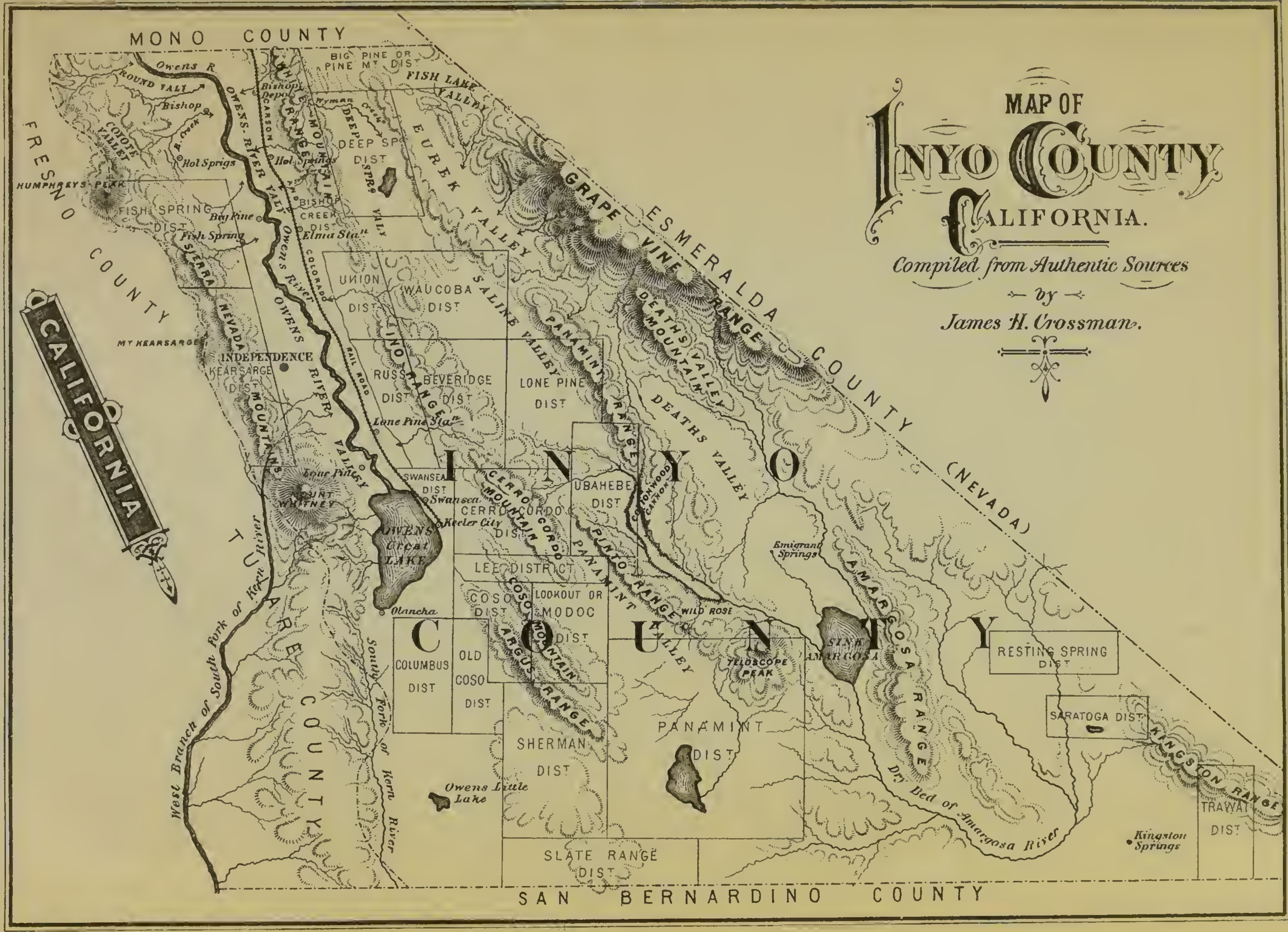
The following statement will show the amount produced in 1883 and from what sources obtained: At Orleans Bar, from hydraulic mining, $51,000; from Thompson's and China Flat, $10,000; from Gold Bluff, $38,700; total, $99,700.

The agricultural interests of this county are very important, and of more interest than the mining. Stock-raising and lumber manufacturing are also leading industries.

### INYO COUNTY.

This county is a long triangular strip of land, with Nye and Esmeralda Counties of Nevada forming the hypotenuse or northeasterly boundary, San Bernardino and Kern Counties the southerly, Tulare and Fresno on the west, and Mono County on the north, and contains an area of over 12,000 square miles, being the third largest county in the State.

Within this area we find two lofty ranges of mountains. The Sierra Nevada, on the northwest, which contains the highest mountain peak in the United States, and a parallel broken chain of mountains lying easterly of this latter range, cannot be classified as a continuous chain, though they bear the common name of the Inyo Range, as it consists of isolated peaks and short ranges, separated by intervening valleys. The most northerly range is known as the White Mountains, a serrated, bold, and craggy chain that at its highest point rises to an altitude of 14,600 feet, and derives its name from the glaring white color of its rocky summit. Thence southerly the Inyo Range proper, followed by Cerro Gordo, Coso Mountains, Slate Range, Panamint, Argus, Armagoso, Kingston, and some of the valleys lying between and surrounding these isolated peaks or ranges are susceptible of cultivation, and are watered by mountain streams and springs, while



MAP OF
INYO COUNTY
CALIFORNIA.
Compiled from Authentic Sources
by
James H. Crossman.

others are barren wastes, deserts, and alkali plains, the latter containing immense quantities of chloride of sodium (common salt), borax in various forms, soda, and sulphur, springs of thermal waters, often forming small lakes or running streams of apparently pure crystalline water, but in reality containing so strong a solution of alkaline salts that for the thirsty man or beast to partake is sure death, while the former, whose water can be obtained for irrigation, are the most fertile lands in the State.

The most notable are enumerated as follows: Round Valley, Deep Springs, Fish Lake, Eureka, Owens River, Saline, Coyote, Panamint, Death Valley, and others of lesser note.

The following are the principal settlements and towns: Round Valley, Deep Springs, Bishop Creek, Big Pine, Owens City, Fish Springs, Camp Independence, Independence, George's Creek, Lone Pine, Olancha, Swansea, Cerro Gordo, Kuler City, Darwin, Reiley, and Panamint.

Inyo is a county containing unusual phenomena of strong and marked contrasts. Its geographical and topographical features, geological and lithological structure and climatic changes, all have wide ranges. Barometrical readings show the highest mountains above and the greatest depressions below the sea-level in the United States. Running streams of pure crystal water empty in to a lake so caustic and alkaline that its effect on the human flesh and skin is immediately felt. Immense quantities of primary granite pierce the clouds, covered with eternal snows, while a parallel range is within 12 miles of a dissimilar formation and structure. The latter range, being in the main metamorphic, or Lower Silurian, contains metamorphosed clay slates, alternating with strata of metamorphosed granites and crystalline rocks, and in places a succession of gray, black, and carbonaceous limestone strata, often of a shaly structure, vastly disturbed, tilted, and broken by a forced intrusion of porphyritic and granite rocks. This range has been the theater of violent subterranean disturbances, volcanic forces having been active at a comparatively recent date. Large areas are covered by lavas, volcanic glass, and tufas. Numerous thermal springs of chemical waters, and resultant gases, show that the subterranean forces are not dead but sleeping. Here the strata lie regular in their strike and dip, then brecciated and thrown by powerful convulsions of the forces of nature into inextricable confusion. Heated gases and vapors stain the rocky formations with bright and vivid colors, red, green, yellow, brown, and black, and their various shades, presenting such weird pictures of desolation as an artist would make but a feeble attempt to portray. This range has also been extensively eroded, as is evidenced by the numerous deep arroyos traversing the chain in a course usually transverse to the trend, often affording natural roadways of easy grade and passes through the mountains.

In the southeast corner of this county we find "Death Valley," a deep depression in the earth's crust, in one place much below the level of the sea.

In this mountain range are found innumerable metalliferous veins, carrying the ores of nearly all the metals and minerals useful to man, both precious and base, in inexhaustible quantities.

The soil of the adjacent valleys is composed of saline and alkaline deposits in such vast quantities that generations cannot exhaust them.

Perpetual snow is found on the summit of the Sierra Nevada, and consequent extreme thermometrical readings. At a lower altitude a temperate clime, with a mean temperature of 59°, is found; in the deserts a torrid zone—a mean temperature of 110° in the shade.

The Sierra Nevada furnishes living streams of pure water fed by melting snows, and its flanks are covered by forests of timber, while its companion range, the Inyos, has but a scant supply of these essentials so necessary for the wants of man.

Inyo is essentially a mineral county, its rocky formation being the storehouse of its greatest wealth, notwithstanding the county has a large area of agricultural land watered by perennial streams, and the soil is so productive that if under a proper state of cultivation Inyo could export instead of importing the necessaries of life for a large population.

As a matter of interest to scientists, evidences of a prehistoric race of men are found at several places in the Inyo Range. Hieroglyphic characters are seen deeply chiseled by some cutting instrument on the flat surfaces of rocks, representing extinct species of animals, while the bones of the mastodon and other animals of the Mammalian age are found in the vicinity.

The population of the county in 1880 was 2,500, but at the present time is estimated at 3,400.

Independence, the county-seat, is 658 miles from San Francisco.

*Notable altitudes in Inyo County.*

| | Feet. |
|---|---|
| Mount Whitney, above sea-level | 15,015 |
| White Mountains, highest point | 14,600 |
| Telescope Peak | 10,937 |
| Rex Montis Mountain | 13,005 |
| Rex Montis mine | 12,480 |
| Beveridge | 10,000 |

The main branch of the Owens River rises in the White Mountains on the northeast, but receives its principal water supply from its tributary branches that flow from the Sierra Nevada snow-capped mountains on the west. The melting snows, innumerable springs, and periodical rains keep a steady and constant flow through its channel. This river enters the county on its northerly boundary, flowing southerly, forming a deep basin between the two ranges of from 6 to 8 miles in width of arable land. The river debouches into Owens Great Lake, so called to distinguish it from a smaller lake of the same name.

Owens River Valley is the valley referred to, which with Long Valley contains 66,689 acres of agricultural land, of which 13,800 are inclosed and 8,000 under cultivation. This acreage forms the principal agricultural land of the county.

The soil of this valley, extending 125 miles, is so generous wherever irrigated that it produces all the cereals of the temperate zone. The sodas from disintegrated lavas and volcanic *débris* make it the home of the vine. Alfalfa produces three crops of hay, making 5 tons per acre each year. Gramina and other wild nutritious grasses are indigenous to the soil, rendering the valley well adapted for dairy or stock purposes. Bee-raising is also a profitable industry, the bees feeding on the alfalfa blossoms, producing honey of a fine flavor.

On a tributary of Owens River, in the Sierra Nevada Mountains, a saw-mill furnishes lumber of any required dimension from the pine forests.

Owens Lake is 17 miles long, 9 miles wide, and 9 feet 10 inches in depth, its superficial area being 110 miles. The lake has no visible outlet. Its waters by infiltration and evaporation have become heavily charged with saline and alkaline matter. Its waters are frequented at certain seasons of the year by aquatic fowls of the duck species, as well as birds of passage, also geese, swans, and pelicans, which feed on small flies the product of a worm with which the waters of the lake abound, and which affords a harvest of worm-food for the Indians that live in the vicinity of the lake, who gather the worm, shuck it of its skin, a silicious covering, pound it to a flour, and eat it as bread with pulverized seeds and pine-nuts.

An analysis of the water, by Professor Philips, of London, gives the following results:

| | Per cent. |
|---|---|
| Chloride of sodium | 2,942.05 |
| Sulphate of sodium | 956.80 |
| Carbonate of sodium | 2,914.43 |
| Sulphate of potassium | 35.74 |
| Silicate of potassium | 139.34 |
| Organic matter | 16.94 |
| Iodine | Trace. |
| Specific gravity | 1.76 |

The mineral resources of this county first came into notice in 1859. Mr. Hill entered the Owens River Valley *en route* for the Potosi Mountain, which lies beyond the Armagosa Valley, for the purpose of visiting Mountain Spring mines. He left a portion of his party at Lon Pine and Cerro Gordo, where numerous mineral discoveries were made, veins located, and districts formed.

Dr. French and party shortly followed in search of the celebrated Gunsight lode. The first entered Coso and Darwin Cañons, made several locations, and penetrated as far as Furnace Creek on the east side of Death Valley, and rediscovered the old furnaces that were used by the Mormons for smelting the galena and carbonate ores with which this section abounds.

Dr. French's party returned in 1861, and Dr. George, of Visalia, organized a party, and, following the same route, discovered and named Wild Rose Cañon, formed the district, entered and examined the Panamit range of mountains, named Telescope Peak, and entered and examined Slate Range for 100 miles in length. The Indians becoming troublesome, they were obliged to leave the country.

In the following spring they refitted and enrolled a strong force of prospectors, well armed and equipped for a voyage of discovery. In South Mountain, Colonel Russ and party joined forces, and a portion of the party was detained and dispatched to Wild Rose Cañon; the remainder discovered and named "Union district," located many mines, and named the Inyo Range. This name was derived from the Indians, who, when asked a question in English, no matter what it was, would always point to the mountain range and exclaim, "Inyo."

The Indians seemed to place no value on the minerals; even nuggets of gold were to them as dross, but they objected to the white men killing their game, cutting and burning their timber, and their grass taken by the white men's stock; and the water from their springs was "tabooed" to the hated race, they believing that water taken from a spring would not be renewed, and that the spring would go dry. They broke out into open rebellion and waged a relentless war. United States troops were called to protect prospectors and settlers, and a fort at Independence was established.

An Indian raid and massacre of a small party of settlers caused a general pursuit by both soldiers and citizens. The Indians were repulsed and 37 driven into Owens Lake. This broke their strength and courage, and in 1863 they surrendered *en masse* (900) to Captain McLaughlin, who was then in command, the captives being taken to Fort Tejon and placed on the reservation. This ended the Indian war in this section, and settlers, farmers, and miners flocked into the hills and mountains, prospected claims, and located districts; towns sprung up as if by magic, mills were erected, &c.

The miners, unaccustomed to this class of ores, attempted to work them "free," without roasting, and signally failed. Poor results obtained, ores pronounced base and untractable, the country isolated and distant from a base of supplies, transportation charges excessive, stock speculation and not legitimate mining the main object, operators' capital small and soon exhausted, are certainly reasons enough for the wane of the excitement, and the county received a set-back, more particularly as other districts more accessible were daily springing into life. An exodus took place, and Inyo County became deserted by all but a few good stayers and enterprising men, that flocked around the standards of Belshaw, Judson, and Beandry, who were organizing a force at Cerro Gordo preparing to open these, to be, celebrated mines and erect reduction works. These mines were worked with remarkable success until 1874, when litigation, the foe of all enterprise, appeared and the mines were closed down. But a new era has dawned. Litigation settled, ores that once were considered rebellious are now worked by ordinary mill process at much reduced expense, machinery, supplies and labor are cheaper, and last but not least that great civilizer, the iron horse of the Carson and Colorado Railroad, has put in an appearance and penetrated this section, with transcontinental competing roads in process of construction which will soon cross and recross these mountain fastnesses, desert wastes, alkali plains, and agricultural valleys, westward bound for the waters of the Pacific. Ores that would not pay transportation charges by pack-train and "prairie schooner" can now either be profitably reduced on the ground or shipped by rail to a market, and Inyo with her rich mines of gold, silver, copper, lead, antimony, borates, sodas, and sulphurs will soon come to the front as a prominent producer.

Surveying parties have been in the field in Southern and Eastern Nevada for two seasons, extending lines of surveys towards the Pacific.

For the past yield of the precious metals from this county, Parker's Inyo Directory is responsible for the following statement:

"No adequate statistics of the output of gold, silver, and lead have ever been compiled. Consultation of all authorities and the most careful estimate, however, place the total yield at $14,850,000, not including the value of the numerous shipments of lead. This comprehends the result of all mining operations since 1862 to the present time, including also the product of 37 reduction works and exclusive of numerous arrastras and vassos."

### MINING DISTRICTS.

The most northerly district is *Bishop's Creek* lying on the western flank of the White Mountain. The White Mountain rises sharply from Owens River Valley, Owens River and the Carson and Colorado Railroad skirting its base in near proximity, its cañons steep, rocky, and soilless, while over their rocky sides streams of pure water flow to the valleys below, sufficient at all seasons of the year for irrigating purposes, and in many cases for motive power.

The White Mountain is formed of metamorphic slates, granites, porphyry, and lime, with a general parallelism coursing with the trend of the chain northerly and southerly. At an elevation of about 1,500 feet from the valley we find an important belt of gold-bearing quartz veins, the formation being traceable on the line of its strike as far as Bodie, northerly, and cropping out at intervals, but persists in this metalliferous belt and cuts the formation at a small angle and dips into the mountain easterly at varying angles of inclination. The veins lie in parallel strata, and generally within a few feet of each other. They vary in width from 2 to 6 feet, and carry exceptionally high values in gold, accompanied with copper and iron base. At and near the surface the ore is decomposed, the copper taking the form of oxycarbonates and the iron hydrated oxides; the gold, consequently, being in a free state. In depth below the line of decomposition the ores are sulphureted, and concentration and chlorination must be resorted to to save the precious metal. There are numerous locations of much promise in this belt, with but little done to prove their value. The most prominent are enumerated as follows:

The Piute, which crosses a creek of the same name near the Mono boundary line and but a short distance south of the Sacramento mine, is a producing mine with a 5-stamp mill, and in the same belt. There are of this series three parallel veins, the most westerly being developed by three shafts 200 feet apart, and from 120 to 150 feet in depth. The vein is from 3 to 10 feet in width, and the ore yields, by mill process, from $15 to $25 per ton. The creek affords sufficient water for water-power for a 20-stamp mill. Southerly from this these veins crop out in numerous places, showing good prospects.

Sixteen miles distant in a southerly direction are found the Golden Wedge, Cork, New Year's, and Iron Cap. These mines show ores very similar in character, but with little development.

The Smith mine is located in Gentries Gulch.

In Silver Cañon are located a series of mines of the same character, but on which very little work has been done.

The Polito mine has a shaft 376 feet deep, and an adit of 200 feet. The vein is from 1 to 4 feet in width, and the ore averages $40 per ton in free gold. Five hundred tons of this class of ore are on the dump and thousands of tons of reserve in the mine. The property is owned by Lent & Dean, of San Francisco. There is no mill connected with the mine.

Southerly from this point is the Redding mine, which crosses a cañon of the same name, and with ores of a similar character. The Marguerita is an extension of the former.

The Hyppolite, Falcon, and Mountain Chief are on parallel veins, with but little development.

Still southerly and at a much greater altitude, ranging from 4,000 to 11,000 feet, we find a change in the formation, blue lime and lime shale being the predominating rocks. We are now in the lead belt, the home of argentiferous galena.

The Reed mine, at an altitude of 11,000 feet, is the most prominent and the best developed. It has a vein of from 4 to 6 feet at the surface, covering a large area, from 4 to 6 feet in depth, lying nearly horizontal and covered with a high subsoil. The whole mass seems to be formed of the ores of lead, galena, carbonates, and oxides. Under this blanket of ore a tunnel has been driven into the hill at right angles with the strike of the vein, intersecting it at a point where it takes its regular dip downwards at an angle of 45°. These ores are exceptionally high grade and carry from 60 to 160 ounces of silver to the ton, with exceptional very high assays, and give about 40 per cent. of lead. All the requisites for reduction works, viz, material for flues, timber for coal, and water, are at hand.

The Reed and Boggs is an extension of the above, and its ores are similar.

Easterly from the summit of this range we enter the *Deep Spring district.* The formation of the east side of White Mountain changes to a more thoroughly metamorphosed formation of slates, granite, porphyries, and limes. The granites are crystalline and secondary in their character, while the slates show some few fossils. The lime is doloritic, carbonaecous, crystalline, and often shaly in structure. In this district there are many promising veins of silver and lead, but base containing antimony, arsenic, and iron. Silver, both free and base, but in places containing iron as a base, is also found here. Also some few veins of gold-bearing quartz, with but little development. A scarcity of water has prevented extensive developments.

In the vicinity of Cottonwood and Wyman's Creek are a series of silver-lead mines, upon which a furnace was erected, but the ores proved intractable and work was discontinued. At the present time, however, the mines are being worked, the best ores selected and sent to a market.

From Wyman's southerly are found numerous veins and series of veins of base silver ores (copper and lead).

The Cinderella has a 6-foot vein of $100 ore.

The Oriental has a 75-foot shaft and a 6-foot vein, and assays in silver and gold $40 per ton.

The Half Dollar has a shaft 100 feet in depth, with an 11-foot vein, which gives an average assay of $55 per ton. Ore is being selected worth $200 per ton, and shipped to the Elma furnace for reduction.

The Red Lion is a strong ledge, and assays $25 for milling purposes.

The Trade Dollar is a narrow ledge, from 2 inches to 24 inches, of very high-grade ore, the ore being selected for shipping purposes ranges from $500 to $800 per ton.

The Indian Scout is a 6-foot vein; ores, chloride of silver, of low grade, and but little developed.

The Scott Brodie and Greenleaf lies at the head of Cottonwood Cañon. It has a shaft 80 feet in depth, with a 4-foot ledge. Ores, argentiferous galena, carrying 80 ounces of silver and 45 per cent. lead.

Near the valley, in the granites, are found several promising gold and silver bearing veins, ranging from 3 to 7 feet thick—ores averaging $35 per ton—but no water.

The Champion has a shaft 70 feet deep, vein from 3 to 4 feet wide; rock assays $25 per ton. No work has been done on the mine since one of the owners was killed by the Indians several years ago.

The *Sylvania district* is situated on the extreme northeast corner of the county. Formation, lime and syenite. It is 39 miles from the Carson and Colorado Railroad, over an almost impassable range of mountains, and 70 miles from Candelaria, in the State of Nevada.

The following mines are on the boundary, half in Nevada and half in California:

The Stanfeldt Company's mines consist of a series of well-developed silver-lead mines, with a large body of ore in sight. These mines have been sufficiently developed to guarantee them valuable mines, and no longer prospects.

The Uncle Sam, Hazel Green, State Range, and Emma Nos. 1 and 2 are opened by shafts from 100 feet to 200 feet on each vein—700 feet of lateral drift run; 1,000 tons of ore on the dump of an average value of

45 ounces of silver and 37½ per cent. of lead, principally carbonates. Wood and water in the vicinity of the mines abundant.

In this district we find an extensive belt of cupriferous ores in the contact between the lime and syenite. The ores at the surface, oxide and carbonates, show 40 feet in width, and are traceable 1,000 feet. The average assays are 20 per cent. copper. This district has been but little prospected, being so remote from a base of supplies. A heavy belt of nut-pine timber is also found here, said to cover 10,000 acres, and it is more than probable that some of the transcontinental railroads will pass through this district, as it is the most feasible route.

Adjoining Deep Springs district on the south is *Big Pine* or *Pine Mountain district.* Formation, porphyry and lime. Near the western boundary is found a series of veins carrying silver-lead ores, assaying 70 ounces of silver and 40 per cent. lead. No developments have been made.

Westerly from Bishop Creek district lies *Fish Spring district.* Formation, granite, porphyry, and lime. But little development has been made on any of the locations in this district; ores, free silver and gold.

*Kearsarge district* is situated on the easterly flank of the Sierra Nevada Range, the summit being the dividing line between Fresno and Tulare Counties. The district is west of Owens River Valley, and 8 miles from Independence. The metalliferous portion of the district lies at an altitude of from 10,000 to 14,000 feet. The mountain range here is bold, craggy, and precipitous. Formation, granitic copper. The district has a frontage on the valley of about 35 miles. The principal stream is the Little Pine Creek, which takes its rise near the summit. Its source is in a series of small mountain lakes. The creek is precipitous in its descent, affording every 300 feet for a distance of 5 miles water-power for innumerable mills. At its lowest stage it carries 150 inches of water, miners' measurement. This great altitude seems to be suggestive of the Potosi and Cerro Paso mines of Peru and Bolivia, that produced their hundred of millions of silver at about this altitude.

Here are found belts and series of belts of silver-gold-bearing veins, with alternate dikes of porphyry and trap in granite (the work of ages), the latter coursing with the trend of the range, while the ore-bearing veins of quartz cut the formation at small and varying angles, generally standing vertical in their incasing walls. These mines are so situated that they can be worked by adit levels to great advantage. The veins are strong and well defined, carrying two classes of ores:

First. The surface ores, or those above the line of decomposition, are free milling, chiefly chlorides of silver, with occasionally bromides and iodides, the former 75 per cent., the latter 57 per cent. and 46 per cent. of silver, and the rich silver glance 71 per cent. in combination with a small per cent. of sulphur. The ores yield their metal by raw amalgamation.

Second. In depth and below the water-line the ores contain sulphuret arsenic, with some copper, a polybassite containing 75 per cent. of silver; also ores containing a small quantity of lead as a sulphide from 65 to 75 per cent. of silver, the latter requiring roasting to be successfully treated.

Of the several groups the Rex Montis is the most important of the Potosi series. They are situated at an altitude of about 12,000 feet, and consist of fourteen locations, being the Potosi from No. 1 to No. 10, inclusive, and the Rex Montis, Shawmut, and Roanoke.

The Rex Montis, on the 400-foot level, carries a 6-foot vein, the Shawmut a 14-foot vein, of which the whole is ore, with a small streak of 18 inches on the east wall that gives assays of from $2,000 to $3,000 per ton. The company have a 10-stamp mill. A sampling was made from the following mines with the results named as the average value per ton of the ores: Shawmut, $117.90; Rex Montis, $109.11; Arctic, $86.75. The ores were worked to 70 per cent. of their value. During the time the mill ran the total yield, as per mill return, was $69,548. Notwithstanding the high tenor of these ores, the conditions were such that they proved unremunerative. Inaccessibility, cost of packing the ores from mine to mill on mules or burros, remoteness from a base of supplies, a heavy rate of interest upon a debt contracted for development and construction purposes, and high altitudes, were all drawbacks to such an extent that the mine was obliged to close down. It is, however, now believed that the company will soon be reorganized on a much stronger financial basis. A tunnel or adit level has been projected, called the Independence tunnel, to be driven to intersect the series at a distance of 2,036 feet, giving 1,320 feet of backs, affording reserves and drainage for many years.

The Kearsarge Company own a series of veins situated at an altitude of 9,000 feet, and in connection have a 10-stamp mill. These veins vary from 3 to 5 feet in thickness. The Cliff and Virginia are the best of the series. For the former an adit level has been driven that will, when the veins are reached, give extensive backs and drainage. The works are for the above reason idle at present.

The Silver Sprout Company own a series of sixteen veins, varying from a small streak to 16 feet in width, all within a width, at right angles, of 516 feet, and are situated at an altitude of 11,000 feet.

In addition to the mines enumerated, there are a large number of locations owned by private individuals, who firmly believe in the future of these mines and work on them in developing as their limited means will permit.

*The Ubehebe district.*—Formation, granite and lime, with trap and porphyritic dikes. This district is principally noted for its large veins of copper. The ores are carbonates and oxides, assaying from 20 per cent. to 60 per cent. But little work has been done here.

*The Union district* is in the Inyo range of mountains, south of Independence district.

The Montezuma mine is situated about 8 miles southerly from Big Pine, in the low foot-hills of the range. Its ores are hauled to Elma, on the Carson and Colorado Railroad where a 30-ton furnace has been erected by the Owens River Smelting Company. They also have sampling works connected for the purpose of purchasing any ores that may be offered for sale, and have sufficient capital to conduct the business. The above mine exposes at or near the surface a large amount of low-grade argentiferous galena lying quite flat. As yet the vein has not been opened in depth, though a tunnel has been driven to intersect the vein when it shall take its regular dip into the hill. The ores exposed contain 30 ounces of silver per ton and 38 per cent. of lead. About 1,500 tons of these ores are now at the furnace, and it is running successfully. In this district are also found a series of gold-bearing veins, some of which are considerably developed.

The Eureka Company, a New York organization, own a series of veins that vary in thickness from 2½ to 4 feet, and are opened by an adit 100 feet long with lateral drifts and stopes. The ores are reduced in a 10-stamp mill belonging to the company, and yield from $10 to $50 per ton.

*The Beveridge district.*—This district is in the Inyo Range, and lies north of Cerro Gordo and Swansea districts, and at an altitude of 10,000 feet. Its formation is granite and syenite, with occasional dikes of trap and porphyry. Several important groups and series of gold-bearing veins are found here. They are generally small but persistent on their line of strike, and as far as developed carry their ores to the "deep"; they course easterly and westerly, cutting the formation at varying angles. The ores are of an unusually high tenor and richness. They are principally owned by Mexicans and worked only when the necessities of the owners demand. The developments are never in advance of immediate requirements.

In this district, on the western slope of the Inyo Range, and at a point only accessible by a mule trail, is located the Keynote group of mines, consisting of a number of veins of gold-bearing quartz.

The principal mine of the group is the Keynote, which is developed by a series of levels driven in on the vein. The lowest or adit level is 750 feet in length and its face in high-grade ore. From the end of this drift, at a point 500 feet from its face, a winze was sunk to a depth of 80 feet vertical, and ore extracted that milled $80 per ton. From this level to the surface the ore has been extracted and milled. The vein varies in size, from 18 inches to 5 feet. The numerous stringers or feeders that fall into the vein are of extraordinary richness, and followed by the miner until they are exhausted or pinch out.

The other veins of the group have been but little developed, but so far as worked have proven valuable. The group consists of the Keynote, Ibex, Alturas, Oro, True Business, and Mundan.

The ores from these mines were formerly reduced in Mexican arrastras, of which a large number, driven by horse-power, were constantly in operation. Recently, however, finding that better results were obtained at a less expense by having the ores reduced in a custom mill erected for that purpose, they have adopted that system.

The following results have been taken from the record kept at the mill; therefore they are correct, as all rock is carefully weighed before it is crushed.

| Name of mine. | | Weight of rock. | Value. |
|---|---|---:|---:|
| Keynote | tons | 819 | $77, 385 |
| Mill custom group | do | 261 | 8, 547 |
| Keynote | pounds | 975, 612 | 18, 999 |
| True Business | do | 103, 219 | 2, 844 |
| Blackboard | do | 115, 112 | 1, 904 |
| Hidalgo | do | 119, 951 | 1, 323 |
| San Ignacio | do | 58, 491 | 679 |
| La Cachora | do | 19, 861 | 709 |
| El Pemasco | do | 17, 742 | 562 |
| Matson | do | 18, 823 | 576 |
| Britton | do | 42, 330 | 280 |
| Los Angeles | do | 15, 659 | 126 |
| Santiago | do | 20, 172 | 168 |
| La Cueva | do | 25, 534 | 143 |

As will be seen, these ores are from fourteen different crushings of different mines, and go to prove the values of the ores crushed. Much of the ore is crushed in arrastras, of which no record could be obtained. Messrs. Harris & Rhine, bankers at Independence, informed me that the output of the Keynote for the last thirty months has been over $300,000.

The Larky mine, adjacent to the mill, has a vein from 2 to 6 feet wide, and its ores yield $40 per ton.

The Gold Hill, Nos. 1, 2, and 3, Golden Gate, Nos. 1 and 2, Golden Reef, Golden Fleece, New Year's, and Reavis all contain veins similar in character to those of the Keynote, but not so rich.

The Hidalgo Group is a series of small and parallel veins, worked by Mexicans on tribute, who assort the ore very closely and work in arrastras. This ore, when assorted, yields about $420 per ton, while when in place is worth from $60 to $120 per ton.

In Freeborn Cañon is found a group of small veins, which vary in size from 2 to 3 inches, but very little work has been done upon them.

Of this group the Elgin has a shaft 60 feet deep with a 3-inch ledge and $70 ore.

The Paddy Jack is a small vein of high-grade ore, is regularly worked, and a bullion producer.

Hanger & Brott own a series of veins from 2 to 2½ inches of $50 ore, and have a 4-stamp mill.

In Craig's Cañon the Laura mine has a shaft 100 feet deep, with a 4-foot ledge. Ores average about $40 per ton in their 4-stamp mill.

The Beveridge mine has a shaft 30 feet deep, with a vein from 2 to 5 feet of good ore.

The Borago Broncho mine, owned by Hunter & Hughes, is a promising gold mine and a steady producer.

The list of mines enumerated in the returns from the Larky mill are all, excepting the Keynote and Hidalgo, from scattering locations in the district, the veins averaging the same size as those above described.

The *Waucoba district* is in the Inyo Range east of Union district. Its formation is metamorphosed granite, porphyry, and lime. The ores of this district are silver-lead.

The Columbia and Waucoba mine has a vein 8 feet thick, and assays $147 in silver and 60 per cent. of lead. But little work has been done on the mine.

*Lone Pine district* lies south of Cerro Gordo district. Formation, lime and metamorphosed slates. The principal mines are the Pioneer, Rosario, and Steele. Ore, silver and base. Developments, light.

*Independence* or *Russ district* lies east of Owens River, and north of Swansea district, on the Inyo Range. Formation, lime and metamorphosed granite, with porphyrytic dikes. Margourka Cañon divides the district at about its center, and forms the dividing line between the calcareous and metamorphic rocks, the former containing veins of argentiferous galena of a low tenor, and the latter veins of gold and silver with copper as a base.

The Eagle mine has a ledge from three to four feet in thickness, giving about 25 ounces per ton of silver and 25 per cent. of lead.

The Eclipse was sold for $100,000, and stocked for a much larger sum. It is now known as the Brown Monster. Its ores are argentiferous, auriferous, and cupreifrous. A 30-stamp mill was built, and a railroad from mine to mill, a distance of 4 miles, a water-ditch 6 miles in length, and $200,000 extracted, but the property becoming involved was sold under an execution and bought by its present owner, who is developing the mine preparatory to the resumption of work and paying expenses by extracting and shipping the ores. There is also a parallel streak of galena ore accompanying the main vein, assaying $81 in silver and 60 per cent. in lead. The mine is developed by a shaft 407 feet feet deep, showing the vein to be 10 feet thick.

The Arish mine is an extension of the Brown Monster. The yield from the ores of the Arish, crushed at the Brown Monster mill, gives about $40 per ton. In this vicinity there are also a number of gold-bearing veins from 18 to 36 inches in thickness.

The Waco Star mine has a 5-foot ledge carrying gold worth $40 per ton and 8 per cent. of copper.

The Golden Star has a 2-foot ledge; shaft 80 feet deep; ore yields from $50 to $80 per ton.

The *Swansea district* lies south of Beveridge and Independence districts. The Carson and Colorada Railroad passes through this district, striking the shores of the lake at the station of Keeler City, the present terminus of the road. At this place is a 10-stamp mill, with sampling works, for sampling and purchasing ores; a depot for lumber, cut by a saw mill opposite the lake in the Sierra Nevada Mountains, 8 miles distant, and flume through which the wood and lumber are conveyed from the mill to the town.

The mines are the—

Coal Burner, developed by a 60-foot shaft, showing a 3-foot vein, carrying argentiferous galena ores.

The Flagstaff has a 100-foot shaft, with a 3-foot vein of galena ore, ranging from $100 to $700 per ton. The ores are shipped to San Francisco for a market.

The Swansea Belle was the first mine located in the district, and for this mine the first furnace in the district was built. The shaft is 140 feet deep, with a vein of argentiferous galena from 4 to 5 feet wide, carrying 50 ounces of silver and 40 per cent. lead. The mine is now being worked.

The Cairo has the same character of ores, with but little done upon it.

The Indiana mine has a 6-inch ledge of silver-lead ore, working out from 100 ounces to 600 ounces of silver and 20 per cent. of lead. The ores are shipped to San Francisco. The mine is being profitably worked.

*Cerro Gordo district.*—This district lies between Wild Rose and Swansea districts, about 8 miles from Owens River, and in near proximity to the Carson and Colorado Railroad. This district, though limited in extent, is large in mineral wealth. The Cerro Gordo Mountain is an isolated peak of the Inyo Range. Its highest point reaches an altitude of 8,500 feet above the sea, and 4,151 feet above Owens Lake. Through this mountain, coursing parallel with the axis of its chain, occurs a succession of strata, as a rule of dissimilar formation from their contact, showing a series of metalliferous veins varying in width from 4 to 30 feet, persistent in their line of strike, and 20 feet, as proved, carrying this ore to the deep.

The veins lie in families of series and groups, each family carrying its characteristic ore, apparently governed by the character of its incasing rock.

In the limestone strata the veins carry argentiferous galena, while the metamorphosed rocks incase veins rich in silver values, but with a cupriferous base, with accompanying carbonates and oxides of copper, while below the line of decomposition glance and other ores of copper occur with a high per cent. of silver.

The mines of this district are historical, and have been so often described that it would seem superfluous to more than refer to them, were it not that the Carson and Colorado Railroad has imparted new life into this hitherto dead and almost deserted district. Work is now being resumed at many points, the energies of the people are being revived, and fresh blood and capital are being introduced.

The metallic domain of this district is composed of compact blue limestone, crystalline and lime shales, quartzite and metamorphosed slates, porphyry, and granite. The gangue of the ore-bearing veins is quartz and spar. The ores vary very much in richness, but as a rule are of high grade. The cupriferous ores range from 40 to 600 ounces in silver and from 2 to 8 per cent. of copper, while the galena ores carry on an average of 50 ounces of silver and from 40 per cent. to 80 per cent. of lead.

This district first came into prominent notice as a metal producer in 1868, though discovered in 1861. From the former date to 1874 it is estimated by well-informed parties that the output of lead bullion was about 30,000 tons, which was shipped to San Francisco, together with a large amount of the richer classes of ores. The value of this product is about $6,500,000. It should be remembered that these veins were worked under the most unfavorable circumstances—remoteness from a base of supplies, excessive charges for transportation, inaccessibility, want of knowledge and experience in treating ores of this class, a scarcity of labor caused by an exodus of the miners to the Comstock and other newly discovered districts, and in an era of excitement and speculation, when every miner that had a prospect expected to become a millionaire, and when the earthquake of 1872 destroyed the smelting furnaces of Swansea, followed by litigation, that enemy to all business enterprises. The result was the closing down of the mines in 1874 and the suspension of active operations.

The Buena Vista mine, in this district, has a 100-foot vein of low-grade argentiferous galena ore. The mine has been but little developed, and its value in depth unknown.

Parallel to the last is located the Union and Santa Maria mine. This mine has been developed to a depth of 950 feet, and extensively worked. The ledges vary in thickness from 3 to 6 feet, and it is stated that the average of the bullion produced was $130 per ton, but generally believed to have run much higher.

On the southeasterly slope of the mountains, in a deep ravine, is found a group of silver and copper bearing veins, the percentage of copper being so small that they are worked only for silver. These mines are owned by a poor class of miners, that remain by their claims waiting for reduction facilities or a purchaser for their properties. Of this series the Belmont is an important vein, and has been considerably developed. It has produced over $500,000 by sale of ores to Belshaw & Co.

A parallel vein in the same vicinity, developed by a tunnel 150 feet in length, shows a body of free-milling ore 10 feet in width and of high grade.

On the northeasterly slope of this mountain, striking Saint Lucas Cañon, on its west side, in a porphyritic formation, there are several well-defined veins of free-milling ore, averaging about 4 feet in width.

On the east side of the cañon are located the San Lucas and the Avalo mines, which are considerably developed. The ores range in value from 50 ounces to 400 ounces in silver per ton, of which regular shipments are being made to San Francisco.

On the west side of the mountain are a series of veins carrying ores of lead, copper, and silver, varying in width and richness, some of which are being developed on a small scale.

At a point 500 feet westerly is the Ignacio Group. Into this group the Potosi tunnel has been driven at right angles, and when completed will intersect the Buena Vista at a distance of 4,400 feet and at a depth of 2,140 feet from the surface, affording drainage and immense backs as reserves. This tunnel will cut the entire series, having already reached the Ignacio, which is being developed with good results. The tunnel is large, being 8 by 9 feet, with double track, and, cutting the course of the mineral belt at right angles, will serve to develop the series, of which may be mentioned the Ignacio, Alpha, San Benito, Santa Maria, Union and Buena Vista, Jefferson, Carmen, Orange, San Felipe, Guadalupe, and Guaymas.

The Ignacio group comprises the San Francisco, Mathilda, Nueva, Summit, and the Greenly veins, which vary in width from 5 to 30 feet, lying in alternate strata in formation of syenite, lime, and slate, all well defined and with a quartzose gangue. These ores are cupriferous, argentiferous, and auriferous, and will work free to a high degree. They average about $100 per ton.

The San Ignacio has been developed by an incline on the inclination of the lode to a depth of 387 feet, and opened up to a greater depth by the Potosi tunnel which belongs to the property, but owing to the death of the principal owner, and to the estate in probate, but little is being done at the mine at present. It is said that this mine has yielded $100,000 from 1,000 tons of ore.

*Lee district.*—This district lies north of Swansea and easterly from Cerro Gordo districts. Its formation is lime, granite, and porphyry. A strong vein of copper ore is found here, stained by carbonates and oxides, and from 50 to 100 feet wide. Very little work has been done. Surface ores assay from 10 to 50 per cent. of copper.

In this vicinity is the Emigrant mine, with a shaft 100 feet in depth, and lateral drifts run which show a vein 4 feet wide, with a rich streak of gold and silver on both walls. On the hanging wall the streak is 6 inches and on the foot wall 12 inches. Assay $200 per ton. The ore is sacked and shipped to San Francisco.

*Wild Rose district* lies on the northern portion of the Panamint Range of mountains, with a formation of lime, slate, and granite metamorphosed.

In Wild Rose Cañon are found several veins of antimonial ore, ranging from 30 to 60 feet in width; also several prominent ledges of silver-bearing veins.

The Virgin, Peru, Kuler, Silver Star, &c., all carry high-grade ores.

In the northern portion of the district is the Mohawk, developed by both tunnel and shaft, with a vein of silver-bearing ore of from 3 to 4 feet thick.

The Blue Bell is developed by an incline of 100 feet and several shafts. One hundred and fifty tons of ore on the dump gave an average assay of $100 per ton. The ores are being shipped to San Francisco. The mine is being developed only from proceeds of the ore.

The Valley View and the Umpire in this vicinity show high-grade ore with veins from 3 to 4 feet thick.

From this point northerly about 6 miles are found the Argonaut, Genette, and Empire State, all of which are silver-bearing mines. The Genette, the best developed of the group, has a shaft 100 feet deep, with a 4-foot vein of free-milling chloride of silver ore. The vein is a contact between dolomite and granite, and assays from 50 to 100 ounces per ton of silver.

*New Coso district.*—This district is south of Lee district and west of Wild Rose. Darwin, the principal town, is 24 miles from Keeler City, on the Carson and Colorado Railroad. This district has been a large metal producer for a number of years.

The New Coso Company's mines consist of the Lucky Jim and Christmas Gift mine, with several other locations of little value. They also have a smelting plant of three furnaces. The two former mines have been extensively worked, but, through mismanagement and remoteness from a base of supplies, have failed to be remunerative. Bullion to the amount of $750,000 has been extracted from these mines, but they are now lying idle. Negotiations are pending with a syndicate of capitalists with a prospect of a sale. The ores are rich, those from the Christmas Gift having averaged $72 per ton, and those from the Lucky Jim about $90. The mines have been opened to a depth of 500 feet, with good ore at the bottom. The ore is argentiferous galena.

The Defiance and Independent mines, owned by Reddy & Gorman, have been extensively worked for many years, and have taken out bullion to the amount of $1,280,000. The plant consists of two 30-ton furnaces. The company is in a prosperous condition and paying dividends. The ores are argentiferous galena, but not as rich as the New Coso ores. The average is about 30 per cent. of lead and $40 per ton of silver. The able management of Mr. Gorman, who is a thorough smelter, has contributed largely to the success of the company.

The Defiance is developed by a shaft to a depth of 290 feet, with lateral drifts, and showing a vein from 30 to 60 feet wide.

The Independent is opened by a tunnel 300 feet long, shaft 80 feet deep; vein, 25 feet wide; ore, similar in character to that of the Defiance.

The Castro has a shaft 200 feet deep, and have extracted 800 tons of ore, with a value of 50 ounces in silver and 40 per cent. of lead.

The Phœnix has a shaft 360 feet deep; ore carbonates of lead, 45 per cent., and 37 ounces per ton of silver.

About half a mile from Darwin is a series of copper mines that promise well.

The Copper Prince has a shaft 100 feet deep, with an 18-inch ledge of high-grade ore, red oxides, blue and green carbonates of from 30 to 50 per cent. of copper.

Parallel to the above is the Copper Grand, with walls 40 feet apart. It is a contact deposit, with ores, carbonates, and sulphides.

The Real del Monte has been developed to some extent; ores are high grade, of silver and lead, and has been worked seven or eight years, and is a regular producer.

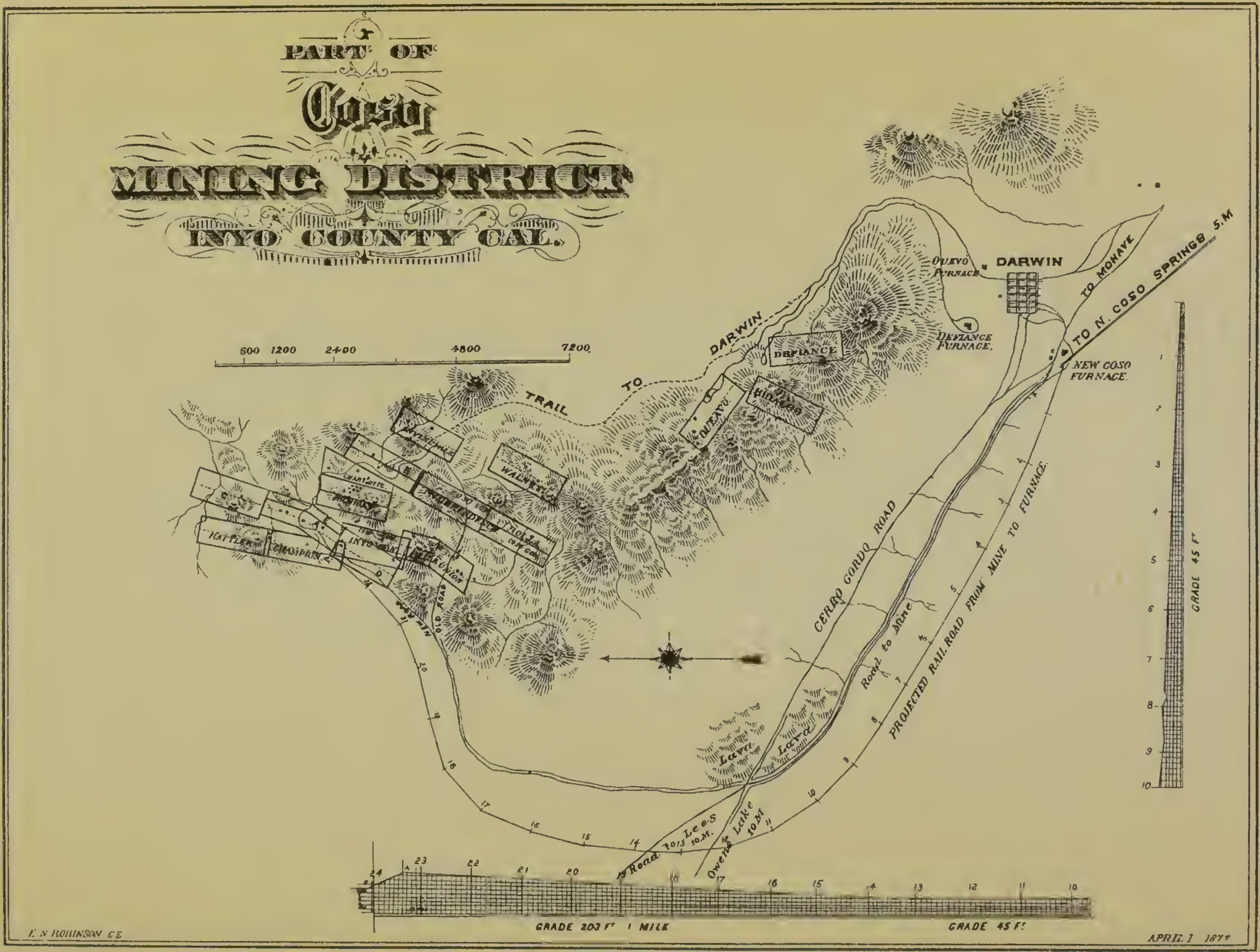
The Panamint, Phœnix, and Prospector are promising argentiferous galena-bearing lodes, with but little development. Also the Reed series, Red Cloud, Old Coso, Branch Mint, Coso Consolidated, and Cabinet.

The Essex mine has been developed by a tunnel 600 feet long, and has produced well, but is now idle.

The Gypsey King has been worked steadily for the past four years, the ores having been reduced at the Defiance furnaces. Average assays show 50 per cent. of lead and 72 ounces per ton of silver.

The cost of supplies in this district is as follows: Charcoal, 25 cents per bushel, wood, $10 per cord, water, 1¼ cents per 1,000 gallons. A 30-ton furnace uses from 1,800 to 2,000 gallons of water in twenty-four hours. Freight on bullion by teams to the terminus of the Carson and Colorado Railroad, and thence to San Francisco by rail, $63 per ton.

*Modoc district*, more generally known as Lookout district, lies south of Lee district and west of New Coso; formation, lime and porphyry. The most prominent group of mines in this district, and the best developed, is owned by the Modoc Company, a San Francisco incorporation. These mines were worked at a loss under the former management, but under the management of Frank Fitzgerald, the present lessee, they are a decided success. The principal mines of the company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RATTLER
CHAMPION
INYO MINE
UNION
NEW ROAD
OLD ROAD
TO MOHAVE
TO N. COSO SPRINGS 5.M
NEW COSO FURNACE.
CERRO GORDO ROAD
Road to Mine
PROJECTED RAIL ROAD FROM MINE TO FURNACE.
Lava
Lava
Road to Lee's 10 M.
Owens Lake 10 M
GRADE 45 Ft
GRADE 203 Ft 1 MILE
GRADE 45 Ft
E. N. ROBINSON C.E.
APRIL 1 1877

are the Confidence, Modoc, and Lookout, situated on the eastern slope of Lookout Mountain, near Panamint Valley, about 12 miles from Darwin. The mines have been extensively developed by shafts and tunnels, a large amount of ore extracted, bullion produced, and are at the present time being successfully and profitably worked. The company own two 30-ton smelters.

The Alabama mine, a recent discovery, is situated three-fourths of a mile from "Darwin Wash"; width of vein unknown, but croppings show a width of 100 feet; ores, carbonate of lead, assaying 40 per cent. with 50 ounces per ton of silver. An open cut in the face shows 30 feet high and 40 feet wide of solid ore. A shaft has been sunk to a further depth of 50 feet and a cross-cut of 30 feet all in ore.

The Old Variety mine is 800 feet distant and 600 feet below on the slope of the mountain. The vein crosses at right angles with the Alabama and will intersect it. An adit has been started on the vein, which shows in its face a width of 5 feet of ore that gives assays of 50 ounces of silver, and carries a very rich streak on the hanging wall which gives large assays.

The Silver mine is situated 6 miles northeasterly from Darwin, and has been developed by a tunnel cross-cutting the vein in four places. One of 450 feet in length gives 100 feet of backs, vein, from 1 to 20 feet thick; ores, galena, giving 40 ounces of silver and 45 per cent. of lead.

The Yankee Blade is a silver-bearing vein, free-milling ore, vein, 8 inches thick, giving assays from $200 to $600 per ton. Developed by shaft 100 feet in depth.

*Sherman district.*—This district lies south of Modoc and in the same mountain range (the Argus) that adjoins the eastern boundary of Panamint Valley. Formation, granite and porphyry metamorphosed.

In Snow's Cañon is found the Argus Range Silver Mining Company. The company have three promising veins; the principal one is developed by a tunnel 700 feet in length; vein varies in width from 18 inches to 5 feet. Ores, chloride of silver, giving assays from $30 to $600 per ton. A 10-stamp mill is constantly in operation, successfully working the ores. The water used is brought in pipes a distance of 5 miles.

In the vicinity of these veins are several locations partially developed, carrying small veins of free gold. A 5-stamp mill has been erected which is now running.

Six miles southerly, in Mitchell's Cañon, Messrs. Mitchell & Hanson have recently discovered a group of high-grade silver-bearing veins, ranging in thickness from 6 inches to 2 feet; 7 tons of test ore shipped to San Francisco sold for $350 per ton.

*Coso district.*—This district lies south of Modoc and Sherman districts, in a short broken range of mountains. Formation, granite. This district was discovered by Dr. George in 1860, and created considerable excitement from the rich gold ores found at and near the surface in several small veins of quartz.

The Josephine mine has been developed by an incline shaft 300 feet deep with lateral drifts; vein from 6 to 20 inches in width. Its ores paid about $20 per ton. A mill was built on the property, but was burned by the Indians in 1861, and was never rebuilt.

The Mariposa, owned by Haggin & Co., has a small vein carrying gold, and assays about $35 per ton. At present it is idle.

*Panamint district.*—This district is in a high mountain range of the same name; its highest peak, Mount Chombo being 12,000 feet high. The district was originally known as the Telescope. Its approach is through Surprise Cañon, a long narrow gorge cutting the mountain range at nearly right angles, or transverse to its trend. In 1874 this district created considerable excitement. Senators Jones and Stewart made some heavy purchases of "prospects," and erected a mill. A supply store was stocked with a heavy stock of goods, in anticipation of another Comstock excitement. The metalliferous portion of this district covers an area of about 6 miles in length by 4 in width. The formation is a hard, blue limestone, in places dolomitized. The veins are numerous, ranging from a seam to 12 feet, often frozen to the encasing walls, irregular in strike, and unreliable in depth. The ores are free and base silver, the base being copper. They can, however, be worked free without much loss. A large number of locations were made and more or less developed, but the mines did not prove remunerative. Recently, however, a New York company purchased some of the more prominent mines and mill, that was built by the former owners, and by a system of tribute work and careful management made them pay until the mill burned down. During the time of working by the latter company about $70,000 was taken out.

The *Resting Springs district* is found in the southeast portion of the county, in the Armagosa range of mountains, of which Telescope is the highest peak; Clark's Fork, passing through the district, takes its rise in the above peak. It is in this district that is located the historical Gunsight mine, owned and operated by the Los Angeles Mill and Mining Company. Vein 2½ feet wide; ores carry a small per cent. of lead base, but are worked free. The mine has yielded to date $260,000. The mine is developed by three shafts, 150, 300, and 400 feet in depth, with lateral drifts and stopes. A 10-stamp mill, 1½ miles from the mine, reduces the ore.

One-half mile from the Gunsight is the Rainbow mine, with a vein from 14 to 18 inches thick; ores, copper-silver (glance), containing 18 per cent. of copper and an average of $100 in silver per ton. Selected ores sacked for shipment have been sold in San Francisco for $640 per ton. The mine has a shaft 130 feet deep, with lateral drifts. The mine is idle at present.

Twelve miles south from Resting Springs is found the Alexander mine, with a tunnel 100 feet long, and a shaft 60 feet deep. Ores, lead, 60 per cent.; silver, 30 ounces per ton.

*Saratoga district.*—This district is situated in a short mountain range about 15 miles long, and at its highest point 8,000 feet. Formation, lime and quartzite.

The Ibex and Zebra mine in this district is owned by a Chicago company. A 5-stamp mill is successfully running on the ores of the mine. The mine has a shaft 100 feet deep, showing a 3-foot wide vein of silver-copper ores, worth from $125 to $200 per ton.

There are other promising veins in the district with but little development. Among these latter are the Cork Louis, Lost Key, Rainstorm, Treasure, Saratoga, Galena, &c.

There is also found in this district a group of argentiferous-galena mines of high tenor, for the working of which a furnace has been erected, but lack of proper fluxes and the distance from base of supplies have closed the works for the present.

The Ibex Mountain is composed of alternate strata of highly metamorphosed rocks, limes, quartzite, sandstone, and slates. Here is found a powerful thermal spring of a temperature of 110° Fahrenheit. The waters are efficacious for rheumatic affections. The waters literally swarm with a small eyeless fish, resembling a gold-fish, which strike against the body when bathing with remarkable force for so small an object. The water is slightly purgative, but not unpleasant to the taste.

*Armagosa district* is situated near the San Bernardino County line, and southerly from Saratoga. Formation, porphyry and slates, highly metamorphosed by volcanic and thermal action. The veins are small, gold-bearing, and unreliable, as the country is distorted and broken by subterranean disturbances.

*Granite*, *El Paso*, and *Slate Range districts* are in Inyo County, in its extreme southwestern portion, and at or near the Kern County line. The mines of these districts are of very little importance so far as developed.

In nearly all the districts in the county is found chloride of sodium (common salt). This important auxiliary for chloridizing and treating the ores of silver and gold is abundant and easily obtained, particularly in the southern portion of the county. It can be had in many places at short distances from the mines for the expense of sacking and hauling, it lying upon the surface of the ground.

The Eagle Borax Company's works are situated 22 miles from Bennett's Wells; capacity of the works, 150 tons per month, now producing 30 tons. The marsh or field is very extensive. There are also borax works in Sherman district and at Furnace Creek, owned by Coleman & Co. Panamint Valley and Saline Valley 30 miles from Independence, contain immense areas of salt nearly pure.

From Big Pine northerly, 15 miles, in Owens River Valley, are found extensive beds of carbonate of soda.

Twenty miles south from the south end of Owens Lake, in the vicinity of Hot Springs, are large deposits of sulphur, the depth of which is unknown, as no developments have been made.

In Long Valley, near the Mono County line, is an extensive bed of pumice-stone; also fire-stone of a superior quality is found here.

## INYO COUNTY, CALIFORNIA.

| Districts. | Formation. | Mines enumerated. | Character of ores. | Mills and tonnage capacity. | | | Furnaces and their capacity. | |
|---|---|---|---|---|---|---|---|---|
| | | | | Mills. | Stamp. | Capacity. | Furnaces. | Capacity. |
| | | | | | | | | *Tons.* |
| Bishop Creek | Metamorphicised slates, granites, and lime | 14 | Free and sulphuretted gold ores and argentiferous galenas | 1 | 5 | 10 | | |
| Deep Spring | Metamorphicised porphyry, slates, granites, and lime | 9 | Gold and silver ores, free and base, and argentiferous galenas | | | | 2 | 10 |
| Pine Mountain, or Big Pine | Porphyry and lime | Group. | (Base) silver ores and copper | | | | | |
| Sylvania | Lime and syenite | 7 | Argentiferous galena and copper | | | | | |
| Fish Spring | Granite, and porphyry, and lime | | Silver and gold (free and base) | | | | | |
| Kearsarge | Granite, syenite, porphyry, &c | 42 | Silver and gold (base and free) | 2 | 20 | 40 | | |
| Vbehebe | Granite, syenite, and lime | Group. | Copper | | | | | |
| Union and Fish Spring | Lime and porphyry | 2 | Silver (base) and argentiferous galenas | 1 | 10 | 20 | 1 | 30 |
| Beveridge | Granite, syenite, and porphyry | 34 | Gold (free), and silver and gold | 4 | 19 | 19 | | |
| Waucoba | Metamorphicised granites, porphyry, and lime | 2 | (Base) silver and lead | | | | | |
| Lone Pine | Lime | 4 | Argentiferous galenas | | | | | |
| Independence, or Russ | Metamorphicised porphyry, granites and slates, and lime. | 7 | (Free and base) gold and silver and copper | 1 | 30 | 60 | | |
| Swansea | Metamorphicised lime and porphyry | 5 | Argentiferous galenas | 2 | 11 | 21 | 1 | 30 |
| Cerro Gordo | Metamorphicised lime, porphyry and trap | 26 | Argentiferous galenas, silver, copper ores (free and base). | | | | 2 | 60 |
| Lee | Granite, lime, porphyry, and slates | 3 | Gold, silver, and copper (free and base) | | | | | |
| Wild Rose | Metamorphicised lime, slate, and granite | 12 | Silver (base and free) and antimonial ores | | | | | |
| New Coso | Lime, syenite, and porphyry | 21 | Argentiferous galena, silver and copper | | | | 5 | 150 |
| Modoc | Lime and porphyry | 10 | (Base) argentiferous galena, silver, and copper | | | | 1 | 30 |
| Sherman | Granite and syenite | 5 | Free gold ores and base and free silver | 1 | 10 | 20 | | |
| Coso | Metamorphosed granite | 3 | Free gold ores | | | | | |
| Panamint | Lime and porphyry | 3 | Silver ores (free and base) | | | | | |
| Columbus | Metamorphic granite | | Silver and gold | | | | | |
| Resting Springs | Lime and porphyry | 5 | Copper and silver, worked free, and argentiferous galenas. | 1 | 10 | 20 | 1 | 30 |
| Saratoga | Volcanic and metamorphic | 8 | Free silver and argentiferous galenas | 1 | 5 | 5 | | |
| Amargosa | do | | Free gold | | | | | |
| Trawat | No data | | | | | | | |
| Slate Range* | do | | | | | | | |
| Granite* | | | | | | | | |
| El Paso* | | | | | | | | |
| Total | | 222 | | 14 | 120 | 215 | 14 | 340 |

*These three districts are but little known, and are situated in the southern portion of the county, if in this county at all. It is generally understood that the last two districts are in San Bernardino County, but by some claimed to be in Inyo County. They are but little known and not considered of much importance, so far as developed.

## KERN COUNTY.

Kern County, in the southern part of the State, is one of the largest counties in the State. The western portion of the county is generally level, and devoted mostly to agriculture, while the eastern portion is mountainous, and embraces the mining portion of the county. As a bullion-producing county, Kern does not rank very high, many of its former producing mines having been worked out and abandoned.

*Sageland district.*—Very little is being done here at present. A 10-stamp mill in this district was destroyed by fire, and there is only one 5-stamp mill left. The principal work of the district is done by chloriders, who work out small veins of quartz.

*Pah-Ute district.*—The Bright Star mine, which has produced a large amount of bullion, is idle at present. It will cost quite a large amount of money to reopen it. It is said, however, that there is a good field for capital here. The work for the past year has been by small parties, at or near the surface of various mines.

*Claraville district.*—The production from this district would have been greater but for the loss of its mill. Its product has come from arrastras and surface work.

*Esperanza district* has done no work during the past year. Between it and Claraville, H. Williams found a very rich mine, which caused the formation of *Cottonwood district*, where three men with an arrastra have taken out about $12,000 at water-level. The chute not being very long, and the ground hard, the miners wisely concluded to stop work. Some of the quartz yielded $300 per ton of gold.

*Kernville district.*—The drain tunnel, over 2,000 feet in length, has been completed to the Big Blue mine, and has drained to its level the two parallel series of mines back of the Big Blue. Work on the mine has been prosecuted with vigor during the past year, and the yield has been large. Sixty of the Summer Company's stamps have been kept in operation for this mine. In November, 1883, the steam hoisting works on the main shaft were fired. The fire is still burning and eating out the supports of the Big Blue mine. Prior to this an air-compressor had been put in the mill, which is driven by water-power, and all the hoisting was done by compressed air. Its practical operation as a motive power was most satisfactory.

*Long Tom district.*—The mill in this district can only run in water seasons. The ledge in the Long Tom mine is holding its own and promises to continue so for years. Tom Lane mine and mill have rested during the past year. Chloriders, chiefly Mexicans, have surface mined, working their ores in arrastras.

*Greenhorn district.*—The dry season of last year prevented arrastra and placer work.

*Agua Caliente* has permanently shut down.

In *Havilah*, or more properly *Clear Creek district*, the companies have done no work, but miners are continually finding rich ore and making what they call crushings at some custom mill.

*Kelso Valley.*—This district needs a stamp mill, which also requires additional expense for water. The dry season has reduced arrastras yield.

*Little Caliente.*—Two parties of miners have been working steadily, using arrastras. The quartz seems to be very good.

In *Pira district* chloriders take out rich gold quartz, and use arrastras.

*Tracy* or *Lehachipi district* has one mine of great length and of liberal formation, which has been profitably worked by its owners for the past two years.

| Districts. | No. of mills. | No. of stamps. | Yield. | Remarks. |
|---|---|---|---|---|
| Sageland | 1 | 5 | $6,000 | 10-stamp mill burned. |
| Pah-Ute | 3 | 28 | 10,000 | |
| Claraville | | | 4,000 | Arrastra work. |
| Cottonwood | | | 12,000 | Arrastra on rich narrow vein. |
| Kernville | 1 | 80 | 128,000 | Summer Company. |
| Long Tom | 1 | 10 | 35,000 | |
| Tom Lane | 1 | 10 | 2,000 | Arrastra work. |
| Clear Creek | 4 | 50 | 6,000 | All custom work. |
| Kelsoe Valley | | | 1,200 | Arrastras. |
| Little Caliente | 1 | 5 | 3,000 | Do. |
| Pira | | | 12,000 | Do. |
| | 12 | 188 | 219,200 | |

## MARIPOSA COUNTY.

The county is situated in the southern portion of the State, and is bounded north and east by Tuolumne County, south by Fresno, and west by Merced.

In the earlier history of placer mining in California Mariposa occupied quite a prominent position among what were at that time called the southern mines, and yielded good returns of the precious metal. At present little mining is being done in this county except in quartz, the old placers having long since become practically exhausted, and are now only being reworked by Chinese, the returns from which, however, amount, in the aggregate, to considerable. The quartz interest is being carried on with its usual energy and vigor, and returns from most of the mines in operation are satisfactory.

The quartz ledges of this county are generally small, but correspondingly rich.

The mines first to be noticed are those in the vicinity of *Hornitos*, *Indian Gulch*, and *Cathey's Valley*.

In the mines owned by Mr. M. Huling, the Yosemite or No. 9 mine, and at the Pool mine, operations are for the present suspended, but will soon be resumed on the completion of the 100-stamp mill, now contemplated.

The Mount Gaines mine is in active operation. Within the last few weeks a rich deposit of ore has been struck, averaging about $28 per ton, crushed at the Yosemite mill, located at the No. 9 mine. About 60 men are now employed.

The Eureka or Quartz Mountain mine, formerly owned by Messrs. Weber & Rodgers, has become the property of M. Huling, but active operations are deferred for the present.

The Dense mine is an extension of the Eureka. It has a shaft 100 feet deep, and yields ore assaying from $24 to $200 per ton, taken from a vein 4 to 8 feet thick.

The Oil City mine, situated on the Merced River, at the mouth of Cotton Creek, about 6 miles northwesterly from Hornitos, has lately become prominent. The vein crops out over the Merced River, extending up the mountain, and is from 4 to 10 feet thick. At first only low-grade ore was found, not yielding more than $7 per ton, which satisfactorily explains why the vein has hitherto been neglected. In the absence of any mill run by water-power such ore could not be profitably worked. Lately a new shaft has been sunk developing a vein 5 feet thick, with ore estimated at $24 per ton.

Mr. Huling has recently undertaken a very important enterprise in connection with these mines. A company has been incorporated, with a capital stock of $1,000,000, for the purpose of building a 100-stamp mill on the Oil City claim, making use of the immense water-power of the Merced River, which is available at this point. It is further designed to build a railroad between the mill and the mines heretofore mentioned. If this part of the project is carried out, it is proposed to crush ore for the mines in the vicinity, belonging to other parties, at reasonable rates. In that case quite a number of mines of low-grade ore in the vicinity of Hornitos will again become valuable.

During 1883 there has been no change in the condition of the Enterprise, Campodonico, Santo Domingo, Amelia, Grimshaw, and Duncan mines.

The Silver Lead mine now belongs to Rollins & Carr, but all operations are indefinitely suspended.

Near *Indian Gulch* is the Gonzales mine, lately acquired by John Weatherbee, of Boston, which has been worked considerably during the past year.

The same parties are in possession of the old French or Mallett mine in the same district, but their title is contested, and the suit is still undecided. The mine has been worked considerably during the past year with good results.

In *Cathey's Valley*, the Christmas Gift and Kendall mines are suspended, the late owners not having sufficient capital to work them successfully.

The Kendall mine has become the property of Dr. J. T. Turney, of Mariposa, while the Christmas Gift will probably, within a few weeks, return to its former owners, the present mortgagees, C. S. Thompson and J. F. Wellman.

During the past year an extension of the Christmas Gift mine, known as the Maggie Johnson, has been worked by its present owner, C. S. Thompson. A considerable quantity of rich ore has been taken out, and is ready for crushing; its estimated value is $25 per ton.

The Juniper and Morning Star mines, situated on the ridge between Hornitos and Bear Valley, have suspended operations within the past year. The owners of the Juniper are expecting to resume operations in connection with the Mariposa Improvement Company, while the Morning Star has returned to the possession of its former owner, Mr. Grosser.

Coming to the mines on *Sherlock's* no important change during the past year is noticeable.

Mr. John S. Diltz, owner of the Diltz mine, has done considerable work upon the mine, in getting out large quantities of ore, and sinking a shaft on the main vein near its northern extremity. For want of proper facilities and lack of water, no crushing or washing has been done, but great quantities of ore, estimated by Mr. Diltz to contain at least $100,000, have been piled up ready for crushing. He proposes to build a mill, on an excellent mill-site owned by him, to crush this ore.

The Breen mine has been worked as a placer mine during the past year.

The Schroeder mine also has been worked, with very favorable results, as far as the limited quantity of water attainable will permit.

The Whitlock, Higman, McCann, and Feliciana mines have undergone no material changes during 1883.

Of the Buena Vista or O'Gorman mines a better account can be given. A 10-stamp steam-power mill has been erected, and about 100 tons of ore taken out, valued at $20 per ton or more. Crushing will soon be commenced.

Malone mines.—These quartz mines were leased during the past year to J. Mitchell & Co. They have done a good deal of expensive preparatory work, including a new tunnel some 200 or 300 feet long, and had just begun to derive some benefit from their labors, when pecuniary difficulties and legal proceedings ruined their undertaking. They did enough, however, to show that the veins are valuable, and capable of yielding the best results in the hands of parties able to work them. Nothing has been done with the Malone placer mines, owing to lack of water.

Sweetwater mines.—The Rollins and Early mines are old mines that have lately come into possession of the Grove Brothers. Work has been commenced upon the Early mine and veins connected with it. They have a 10-stamp mill. The ore already obtained yields from $20 to $30 per ton. No other mines near the town of Mariposa are in successful operation.

In the Ho Bettie mine the ore is of high grade, but too refractory for the limited means of the original locators.

Hite's Cove mines.—Hite's Cove, formerly one of the busiest mining centers in the county, is now almost entirely deserted. The original Hite mine and other mining property of the Hite Gold Quartz Company have finally reverted to J. R. Hite, the former owner, who has not yet had time to determine his future course in this regard.

Coulterville mines.—The Malvina, Mary Harrison, and Potosi mines, owned by the Cook Brothers, are not yet in active operation, but steps have been taken toward that result.

The Virginia, formerly called the Coe mine, has been within the last year sold to a Springfield (Ohio) company consisting of J. S. Crowell and five others. Under the new management active operations have recommenced. They have a 10-stamp mill, and a force of men at work on the mine taking out ore of an excellent quality, and expect to commence crushing soon.

The Red Cloud is another mine in this vicinity, now leased to the Reardon Dry-Ore Separator Company. The lessees have put up considerable machinery and are about ready for active operations.

Bull Creek mines.—The Compromise mine has been in active operation during the whole of the year past. The same is substantially true of the Banderita. The owners have made valuable improvements during the past year. A new tunnel, some 1,600 feet long, has been completed, a water-ditch and additional machinery attached to the mill. The Martin & Walling, belonging to the same owners, is now idle.

The Ferguson mine, north of Merced River, has been worked considerably during the year, but not successfully, and has been, for the present at least, abandoned.

Nothing has been done with the Bushnell vein or the Red Bank hydraulic. The latter belongs to a New York company, and is located on the Merced River near Split Rock Ferry.

The Cranberry is one of a cluster of mines situated on the Merced River about 2 miles above the Ferguson and opposite Hite's Cove, and owned by Otis Perrin & Co., under a United States patent, which includes the Rutherford mine, in the same locality.

For the past year considerable work has been done with a view to working the Cranberry upon a safe and economical basis by the construction of a water-ditch along the river bank, about 2½ miles in length; also, of two arrastras, but which have not been running long enough to afford an intelligent report of the result. The Cranberry is looked upon with great favor, and should the test with arrastras prove a success there will no doubt within a short time be a large water-power mill erected here.

The Red Cloud mine is situated about 10 miles north of Coulterville, on Bear Creek. A shaft has been sunk 130 feet, running down on the vein, which is from 18 inches to 4 feet in width, and the rock, which is free-milling, pays from $10 to $15 per ton. The machinery used for the past year, which consisted of a Dodge's pulverizer and a Reardon separator, proved a complete failure. The company intend placing other machinery upon the mine for reducing the ores. The vein is a true fissure, and as the water-level is reached more sulphurets appear.

## MONO COUNTY.

Mono County is situated nearly due east from San Francisco, its western boundary extending north and south along the summit of the Sierra Nevada Range and its eastern boundary forming the State line dividing California from Nevada, Esmeralda County, in the latter State, being one of the richest in mineral of the Silver State.

Mono County is bounded on the north by Alpine County and on the south by Inyo, both of which are noted for their mineral wealth. It is located in the heart of a mineral region which has proven one of the most extensive and profitable in the United States.

Both placer and quartz mining have been conducted successfully in this county for the past twenty-five years, the last seven, however, having been the most important in its history, consequent upon the discovery and development of the Bodie mines. Their discovery dates back to the year 1860, but their systematic development was only commenced after they had been practically abandoned and neglected for about fifteen years.

In 1877 the Standard mine was purchased and an incorporation formed, and in September of the same year the company paid its first dividend. Since that time no month has passed in which there has been a failure to pay a dividend of from $25,000 to $50,000.

During 1883, dividends of $25,000 per month were paid, with an extra one of $25,000 in December, aggregating $325,000 for the year. Work was prosecuted on the Standard mine on the 385, 500, 700, 1,000, and 1,200 foot levels.

The following table gives the bullion output of the Standard mine in 1883.

*Bullion production of the Standard Consolidated mine, of Bodie, Cal., for the year* 1883.

| Months. | Gold. | Silver. | Total. |
|---|---|---|---|
| January | $85, 499 03 | $13, 904 52 | $99, 403 55 |
| February | 107, 347 28 | 14, 466 10 | 121, 813 38 |
| March | 75, 899 10 | 9, 311 52 | 85, 240 62 |
| April | 97, 939 10 | 14, 996 16 | 112, 735 26 |
| May | 98, 984 98 | 12, 671 36 | 111, 656 34 |
| June | 98, 416 03 | 13, 956 95 | 112, 372 98 |
| July | 81, 244 75 | 13, 963 49 | 95, 208 24 |
| August | 78, 538 33 | 13, 400 45 | 91, 938 78 |
| September | 87, 693 52 | 8, 184 74 | 95, 878 26 |
| October | 79, 619 43 | 8, 777 86 | 88, 397 29 |
| November | 62, 388 11 | 8, 678 50 | 71, 066 61 |
| December | 61, 787 38 | 7, 713 14 | 69, 500 52 |
|  | 1, 015, 357 04 | 139, 824 79 | 1, 155, 181 83 |

The total production of the Standard, by years, has been as follows:

| | |
|---|---|
| 1877 | $784,522 80 |
| 1878 | 1,025,383 35 |
| 1879 | 1,448,845 47 |
| 1880 | 1,858,763 46 |
| 1881 | 2,131,458 87 |
| 1882 | 1,258,056 80 |
| 1883 | 1,155,181 83 |
| Total to December 31, 1883 | 9,662,212 58 |

There are still large reserves of ore in the mine. About 70,000 tons of ore have been crushed during the past year, showing the yield to have been about $16.50 per ton. Fifty stamps are constantly employed in reducing the ore. The 1,000-foot level has shown considerable improvement, and strong hopes are entertained of finding at greater depth another body of ore similar to that which at the surface, or above the 500-foot level, has produced nearly $10,000,000. A vein of ore, 8 feet wide, has been found on the 700-foot level since the 1st of January, 1884, which adds considerably to the value of the mine.

The Bodie mine adjoins the Standard on the south. Its history has been sensational in the extreme, and has been marked by a series of rich developments, which have occurred in each instance when least expected.

In the spring of 1878 the claim was generally regarded as a wild-cat, and the stock had but few buyers in the market at 40 or 50 cents per share. In July of that year the Bruce and Burgess veins were struck. In August the mine produced over $600,000, of which $400,000 was paid to the stockholders in dividends, and the stock reached the price of $53 per share. Something over a million dollars was taken from this first bonanza, which was nearly worked out before the summer of the following year. In 1879, at a time when ore was becoming scarce in the mine, a second discovery was made on the 433-foot level of the Fortuna vein. A season of excitement occurred, and the stock rose to high figures, reaching $48 per share. These successive stock excitements had a material influence upon the fortunes of the district, as they attracted widespread attention. Companies were organized, mining ground purchased, hoisting and quartz mills built, and in 1879 there were 35 mines in operation which worked with a large complement of men.

The Fortuna vein, though narrow, was very rich, and about $2,000,000 have been taken from it up to the present time. The vein has been worked down to a depth of about 800 feet. In working up from the 433-foot level the Fortuna cut through the Bruce ledge, and was supposed to have disappeared in the Burgess, or rather that the Burgess was the apex of the Fortuna vein. A cross-cut was run to the west line of the mine on the 306-foot level, and as it passed through a broken or barren point in the ledge the conclusion was reached that there was nothing of value in the mine west of the Burgess vein. During the last two or three months of 1883 the company was again in straitened circumstances, as regards ore to supply the mill, and in looking around to find ore which could be worked, the Fortuna vein was discovered west of, and therefore crossing, the Burgess. The vein is richer and wider than it was below in the same place, showing streaks of solid silver, filled with nuggets of gold. The Bodie has a 10-stamp mill, located two miles from the mine. It has two vertical shafts, the old Bodie shaft on the west side 450 feet deep, and the Lent shaft, of three compartments, 1,000 feet deep. The latter is owned jointly with the Mono Mining Company, the next southerly location to the Bodie.

During the dullness of the past season the Lent shaft was closed down, prospecting work being discontinued at a very promising point on the 1,000-foot level. With the new development it is probable that work will be resumed at the Lent shaft. During the year 1883, the production of the Bodie was as follows: Gold, $105,176; silver, $141,643; total, $246,819.

*Total production of the Bodie since it commenced producing bullion in* 1878.

| | |
|---|---|
| 1878 | $1,042 236 |
| 1879 | 764,067 |
| 1880 | 429,817 |
| 1881 | 366,105 |
| 1882 | 484,890 |
| 1883 | 246,819 |
| | 3,333,934 |

During the year 1883 the Bodie paid no dividends. Prior to that time it had distributed $1,295,000 among its stockholders, its last dividend having been paid November 15, 1882, of $20,000. It will probably resume dividends again in 1884.

The Syndicate mine.—The 20-stamp mill of this company commenced crushing rock in April, 1883, after it had been closed down for several months. The ore of the Syndicate mine has always been of low grade, but the company are at the present time crushing a better quality of rock than at any time heretofore, and the production was larger in December, 1883, than during any previous month of its history. The mine is worked very economically by tunnel, the mill being situated immediately below the mouth of the main exit. The production of the mine in 1883 was:

| | |
|---|---|
| Gold | $85,667 |
| Silver | 6,372 |
| | 92,039 |

And for the past five years as follows:

| | |
|---|---|
| 1879 | $12,316 |
| 1880 | 24.769 |
| 1881 | 134,706 |
| 1882 | 75,458 |
| 1883 | 92,039 |
| | 339,288 |

The Bodie Tunnel is a mine that has produced considerable bullion during the past three years, as follows:

| | |
|---|---|
| 1881 | $10,628 |
| 1882 | 129,216 |
| 1883 | 51,742 |
| Total | 191,586 |

There have been scattering sulphurets of bullion from this district, including those of John Wagner's tailing mill, of $36,882.

The aggregate of shipments for the year 1883 was $1,582,266. The total production of the district since 1876 is as follows:

| | |
|---|---|
| 1877 | $797,022 |
| 878 | 2,129,732 |
| 1879 | 2,556,847 |
| 1880 | 3,063,699 |
| 1881 | 3,172,988 |
| 1882 | 2,217,780 |
| 1883 | 1,582,666 |
| | 15,520,734 |

During the same period the following dividends were paid:

| | |
|---|---|
| Standard Consolidated, 80 dividends | $4,350,000 |
| Bodie Consolidated, 20 dividends | 1,295,000 |
| Bulwer Consolidated, 15 dividends | 165,000 |
| Total | 5,810,000 |

The Bulwer dividends were derived from the rental of its mill to the Standard Company. Prospecting work has been carried on in the mine during the year through the workings of the Standard mine, but no ore has been worked. A little work has been done in the Bechtel Consolidated during the year.

*Homer district.*—In this district the May Lundy is the best known and most productive mine, and has been successfully worked during the past year. As usual during the winter months the mill is closed down. The property is owned by individuals, and the actual production since its discovery, about four years since, is estimated at about $500,000. About 100 men are employed by the company when in full blast.

The Gorilla Mining Company has employed a considerable force of men during the past year, and is considered to have flattering prospects.

The Josie Green, Rhone Dollar, Little Emma, and a number of other mines in Homer district have been worked to some extent during the past year.

In *Tioga district*, about 7 miles from the town of Lundy, in the Sierra Nevadas, work has steadily progressed throughout the year, and on the mines of the Great Sierra Consolidated Silver Company, the principal work being the running of a large tunnel at the base of Tioga Hill. The tunnel is now of several hundred feet in length, but as yet the ledges, which are of great size on the summit of the hill, have not been cut.

In the old *Monoville district* the Original Creek Hydraulic Company has been steadily worked throughout the past year, most of their time being employed in bringing water to the ground, building reservoirs, &c. The work is now completed, and the company commence the year 1884 with very flattering prospects. Several thousand dollars have been taken during the past year.

*Patterson district*, in the Sweetwater Mountains, has also attracted considerable attention during the past year, although as yet the district is entirely in the hands of the original locators, no capital having been invested there. The district is regarded by competent mining men as the most promising that has been discovered in many years.

The Summers Mining Company has a 5-stamp mill that has produced about $100,000 the past year, nearly all in silver. The ore, which is free milling, has averaged $60 per ton net.

Rich ore has been found in the Homestake, Silverado, Great Western, California, Comstock, Magnolia, and many other mines.

The district is a vast quartz porphyry belt, with ledges of great size. Patterson district may in the future become as famous as Bodie, Aurora, and possibly the Comstock.

The mines of *Blind Springs* and *Clover Patch districts* have been worked quietly, but steadily, throughout the year, the Wild Rose, at Clover Patch, having attracted much attention. The bullion shipments have probably aggregated $150,000.

| | |
|---|---|
| Producing mines: | |
| Oro Fino | $169,280 |
| Banner | 152,520 |
| Way Werey | 82,944 |
| Eureka | 21,800 |
| Pamelia | 12,024 |
| Tower | 196,400 |
| Indian Queen | |
| Lone Queen | 10,800 |
| Gray Carbonet | 80,040 |

## NEVADA COUNTY.

Nevada County has a middle situation in the great auriferous belt or zone stretching along the western flank of the Sierra Nevada Mountains from Oregon on the north to San Bernardino County on the south. Mining is the chief industry of the country, although agriculture and horticulture are carried on quite extensively in the western portion of the county. In the production of fruits of the best kind that belong to the temperate zone a portion of this county cannot be excelled. The fruit region is in Grass Valley, Rough and Ready, and in the western portions of Nevada, Bridgeport, and Little York Townships. These crops are a certainty every year, and the excellence of their production insures the highest prices in the market. In the higher altitudes apples can be produced in unlimited quantities and of unsurpassed excellence in all respects. The fruit capacities of Nevada ought to and can give it a population more than three times that of the present. In the lower altitudes and in the western portion of the county farming is extensively carried on, and there is hardly a grass or a grain known to temperate latitudes but can be profitably grown. Cattle-raising is also one of the industries of the western portion of the county, and many pursuing that business have been rewarded with competencies. Food and forage crops grow on the surface of this county, while gold and other minerals in inexhaustible quantities are in the ground below the soil. The climate is most delightful, being mild all the year round. It is considered cold here in winter when the mercury gets as low as 22° above zero, while in summer it rarely shows 100°. As a gold-producing county Nevada has always taken the lead, and it still maintains that position. Probably no equal area in the world has produced more gold than Nevada county, and no region known has the promise of an equal mining permanency. Its ease of access from the great valleys below has always been a prominent factor in the working and development of its mines. Nevada City and Grass Valley, the principal towns in the county, being connected with the Central Pacific Railroad by a narrow-gauge road from Colfax to Nevada City, a distance of 22 miles, has proven an additional factor in the development of the various resources of the county.

Nevada County was among the first to be worked as shallow placer and river bar mining. The production of gold from this system of mining in early times was large and very remunerative. But as these shallow placers gradually became exhausted, the miners began to search for the source of the gold found in the shallow placers, rivers, bars, ravines, &c. Shafts were sunk, tunnels run in every direction, and ledges of gold-bearing quartz and immense deposits of auriferous gravel were discovered and opened up. It now became necessary to inaugurate a new and entirely different system of mining, involving much greater risk and outlay of capital. In most instances the capital required to start these then new enterprises in mining was so great that it could only be done by joint-stock companies or an association of individuals. Such companies and associations were formed, and prospecting explorations and developments were prosecuted with energy and vigor, until it became known that Nevada County held within her boundaries ledges of gold-bearing quartz and deposits of auriferous gravel, which in extent and richness have never been equaled by anything of the kind in the history of gold mining.

The gravel deposits were and are at present simply immense, and lie between the South and Middle Forks of the Yuba River, and what is commonly known as the "Ridge." This ridge, embraced within the two forks of the Yuba River, is from 5 to 7 miles wide and to the limits of the gravel as far as explored, extends from French Corral on the west to the summit of the Sierra Nevadas, a distance of about 30 miles. This ridge is cut up by ravines descending both ways from the center into the valleys of the two rivers, thus affording fine opportunities for opening up the gravel deposits by tunnel. Large portions of this great gravel deposit are covered with lava containing trachyte, basalt, porphyry, and volcanic minerals, quite foreign to the general geology of the country. The deposits of auriferous gravel vary in thickness from 75 to 200 feet; probably 100 feet would not overestimate its average thickness.

So much has been written by learned and scientific men as to the formation of this great gravel deposit, including the particular age in which it was formed, &c., that it is unnecessary to attempt a thorough description at the present time. One thing, however, is generally conceded, that this is simply the bed of an ancient river which existed when the river system of the country was totally different from that of the present, and that the gold distributed through the gravel came from veins of gold-bearing quartz, which occur so abundantly in all the slates and metamorphic rock of the western slope of the Sierras known as the gold region. The formation of these gravel deposits, the river system of the country at that time, and the topographical appearance of the country during the formation of this channel is a question upon which scientists do not fully agree. Among the earlier theories which were quite popular was the "marine theory," by which it was claimed the formation was due to the action of the sea. Then the "glacial theory" had many advocates, but the surroundings in so many instances disproved both of the above theories, that they were abandoned. Professors Whitney and Joseph Le Conte agree upon the ancient river channel system, but disagree as to what particular age this formation belongs to. Professor Whitney maintains that it belongs to the Tertiary, while Professor Le Conte is equally positive that it belongs to the Quaternary age.

The extent of these deposits having been shown to be very great, embracing about 150 square miles, a few words as to their value might not be out of place. It is impossible to approximate the amount of gold contained in this long stretch of gravel-beds, but from the amount annually taken therefrom for the last thirty years it is safe to say that no recent estimate of its value can be considered too great.

M. Laur, a French engineer of mines, examined this formation some twenty years ago, and estimated that the region under consideration could be worked at a rate that would produce $12,000,000 in gold annually, and that it would be exhausted only after a period of 524 years, which would give as the gold product over $6,000,000,000.

Professor Silliman also made an estimate, and placed the probable yield of gold at the much more moderate sum of $544,000,000. In this last estimate the gravel deposits lying under the volcanic formation were not taken into account, although these are known to be very rich in many places.

But while all the different theories were being discussed by scientists, and speculations as to value among capitalists, the miners and mining men were evolving theories and plans and putting them into execution for the extraction of some of this vast wealth. In order to successfully work this deposit it was necessary to run long and expensive tunnels into the ridge to intersect the gravel and get upon the bed-rock; then shafts sometimes several hundred feet in depth were sunk to intersect the tunnel, requiring in many instances the expenditure of a small fortune before an ounce of gold could be taken out. Then it was necessary to construct immense reservoirs high up in the mountains to impound the waters of the winter season, so that a constant supply could be had during the entire year. Then many miles of ditches, flumes, culverts, distributing reservoirs, &c., had to be constructed to convey the water to the mines.

This system of mining has been successfully carried on for many years in this county, and operated to so great an extent that many millions of tons of earth, gravel, &c., have been washed into the river on either side of this great deposit, and carried by the floods of winter into the valleys below, filling up the beds of the rivers, causing them sometimes to overflow their banks, and covering the adjacent lands with *débris* many feet in depth. About four years ago suits were commenced by the farmers in the valleys below, to restrain the miners from running the *debris* from the mines into the rivers, and injunctions in many instances were obtained, and resulted in closing down hydraulic mines in this county, thereby lessening the yield of gold for 1883. The *débris* question was litigated in the State courts for about two years, and was then transferred to the United States circuit court. Judge Sawyer, of the latter, rendered a decision, granting a perpetual injunction against hydraulic mining. The decision was a severe blow to the mining interests of the State, and will seriously affect the gold production of California for many years to come, and more particularly does it affect the interests of this county, as more hydraulic mining was carried on in Nevada County than in all the balance of the State. But while hydraulic mining has, at least for the present, received a blow, it must not be supposed that all the immense wealth buried in these gravel beds is to forever remain there. There is no doubt but that the skill and genius of the miners and mining engineers will devise ways and provide means whereby the *débris* from hydraulic mining will be legitimately and properly taken care of, so that injury shall accrue to no one. Again, the system of mining known as drift mining will undoubtedly be adopted in many hydraulic claims, which, as is generally known, is to take out the gravel lying next to the bed-rock—generally the richest—through either shafts or tunnels, and then wash through sluices. Many large mines in different portions of the State have been worked upon this plan for many years, and some of them are among the best paying mining properties in the State. It is therefore almost certain that some means will be adopted whereby this stream of golden sand shall continue to pour into the channels of trade and commerce as in years heretofore. Then, again, the immense reservoirs and ditches which have cost such large sums of money can be utilized by extending the ditches down to the more fertile lands in the foot-hills and valleys below, and many industries, other than mining, can be made highly remunerative, while the water companies, from the immense amount of water which they could furnish for irrigating purposes, would receive handsome returns. Again, there are numberless quartz veins of low-grade ore scattered through the lower portions of the county and extending into placer, which could be profitably worked if water-power could be obtained for hoisting and milling the ores, thus giving a fresh impetus to that class of mining.

*Grass Valley* is the oldest quartz mining location in the State, and this class of mining industry has been steadily prosecuted since its first quartz discovery in 1851.

The Idaho Quartz Mining Company have continuously worked their mine for many years past, and paid dividends regularly since 1869. The falling off in the production of bullion in 1883, as compared with the two previous years, has been large. In 1881 the product was valued at $640,000, and in 1882 $627,000, while in the past year it was $362,000; and the dividends have fallen from $271,250 in 1881, and $263,300 in 1882, to $34,100 in 1883. In addition to encountering much low-grade ore, there have been unusual expenses, which have been the means of lessening the dividends paid and causing the passing of dividends for five months of the year, but the disbursements of the company for labor, supplies, and improvements have been more than equal to the product of the mine; as the receipts have been $362,000, and the expenditures, including dividends, have been $378,000. The unusual expense incurred during the past year was caused by substituting water-power for steam in hoisting, and the change seems to have met the anticipations of the owners, both as to economy and efficiency. Self-feeders to the battery were also put in, which has made a material reduction in the cost of milling. Several other changes have been made, all tending to reduce the expenses of operating the mill and mine.

The report of the superintendent seems to give assurance that from the recent introduction of water-power, the general expenses of the mine will be reduced. The average yield of the rock for the past year has been considerably lower than the previous years. In 1882 the average yield of the rock per ton was $20.64, with a cost of milling and mining of $9.83¼. The average yield for 1883 was $12.76, with cost of milling and mining of $8.70. The ore raised the past year has amounted to 28,572½ tons to 27,639 tons in 1882. During the past year the 1,200-foot level has been extended 245 feet and has produced good ore. The 1,300-foot level has been extended nearly 300 feet, and although the vein has been irregular the ore has been of fair quality. The 1,400-foot level has been opened up the past year and extended a distance of 389 feet, but the rock has been low grade. The incline has been sunk 168 feet below the 1,400-foot level, and the prospects of the ledge at this depth are encouraging for a 1,500-foot level. The mine during the past year has met extraordinary expenses in improvements and has done a large amount of dead work.

The Empire mine, which has been one of the chief producers of gold in this district, is in full blast and taking out very good rock. The mill of the Empire Company has been entirely reconstructed during the past year and has been in operation for a few days only. The changes that have been made introduce the latest and best improvements for convenient and economical working, by the introduction of self-feeders and concentrators, which dispenses with all unnecessary manual labor and reduces the cost of milling rock to the minimum. The quartz is run directly from the hoisting works to an upper platform in the mill, where the smallest rock is shoveled through the grizzlies into a bin below, and a rock-breaker reduces the larger pieces to an equal fineness, which are then dropped into the same receptacle. The rock is then fed into the self-feeders as fast as desired, and these in time feed the batteries by means of a lever and rod connection, operated by the stamps themselves, the feeding being done only as fast as required by the batteries and better than can be done by hand. The discharge of pulp through the screens in front of the batteries passes over silver plates, which, in connection with amalgamating in the batteries, take up the free gold, and from there is carried in sluices to the floor below, but at an elevation over the concentrators and fed down to them (six in number) by a distinct stream for each. The concentrators are the Triumph patent, a comparatively recent invention, and claimed to be superior to the Frue, which is in more general use, and has long stood in favor. These six machines take and dispose of all the tailings from the 20 stamps, whereas for the same number of stamps eight of the Frue machines would be required. The Triumph has the general appearance of the Frue and separates the sand from the sulphurets in the same manner, but the endless rubber belt which carries the sand has an end, but not a side motion. The sulphurets being heaviest are carried along with the forward motion of the belt, and the light sand, by means of a small jet of water falling upon the belt, is carried in the other direction, and is permitted to pass off and out of the mill. The sulphurets as separated pass along with the belt as it revolves, which after passing around a cylinder goes through a reservoir underneath the machinery, are washed off, and fall to the bottom. By this operation it is claimed that 95 per cent. of the sulphurets are saved. The concentrators dispense with blankets, pans, settlers, puddlers, and all the old-style apparatus heretofore in use, and make the mill and its appliances apparently the model of simplicity and perfection. These improvements have been made at a considerable expense, but the condition of the mine has warranted the outlay.

The New York Hill mine was one of the early locations of the district, and was worked with profit for many years. Previous to 1874 the mine was permitted to lie idle for several years. It has been worked since until a year ago, and paid dividends. The past year, however, dividends have been discontinued and assessments will probably be the order. Prospecting work and a continuation of the old works at various points in the mine are likely to bring it to the front again as a gold producer.

The completion of the drain tunnel will be the means of starting up the Pittsburg mine within a short time. The tunnel, which is 800 feet long, and has required 2½ years to drive it, taps the mine at the bottom of the 200-foot level, from which depth to the surface nearly all the water comes. Below the 200-foot level the mine does not make much water, as in sinking for the 800-foot level it was not necessary to put in a pump. Now that the tunnel has reached the old workings, boxes will be put in through the whole length of the 200-foot level to catch the drainage above. It will be but a short time until they will begin this work, and then the machinery will be started up and regular operations of mining and milling resumed.

The Maryland is contiguous to the Idaho. A tunnel has been run in 700 feet and a shaft sunk 125 feet, connecting with the tunnel. A station has been blasted out to introduce water-power.

The Imperial mine is pushing its work along with earnestness and vigor; new pumping machinery has been put up and the sinking of the shaft resumed. It is the intention of the company to sink from 100 to 200 feet further, so as to get well below the level of the creek, the shaft now being 178 feet in depth, with a 3-foot ledge in the bottom. It is confidently expected by the stockholders that they have another Idaho. The quartz and walls of the Imperial have the same characteristics as the Idaho.

The Pawning mine is undoubtedly located on the Eureka and Idaho ledge. A shaft is being sunk which will strike the ledge at a depth of 100 feet perpendicularly, and then the pitch of the ledge will be followed. There is every indication that a pay chute will be found.

The Magenta Consolidated mine is one of the oldest locations in Grass Valley district, and adjoins the property of the Empire Company. It has been worked with but little interruption for the last thirty years, and at the present time is being worked with as much profit as at almost any time in its history. Some nine years ago the company became involved in legal difficulties and the property was sold and passed into new hands. Within the past three years the company has been reorganized, and during the past year active measures were taken to renew work, by putting up new pumping and hoisting machinery. The works are substantial in construction and conveniently arranged, and active operations are now in progress in clearing out the old works and levels and running new ones. The shaft carries the ledge with it, and between the second and third levels a ledge, known as the Mohawk, intersects it at nearly right angles. There is also another large ledge running nearly parallel to the Magenta ledge. The existence of this ledge has been known for a long time, and recently, in running a tunnel to draw off the surface water, this ledge was encountered and found to be four feet in thickness, of excellent quality, carrying galena and sulphurets, and showing free gold. It is one of the best ledges that has been struck in this district for many months, and owing to its close proximity to the main shaft can be easily opened.

The Mascotte mine is being worked night and day, and indications show that a good quartz ledge is close at hand. This mine is supposed to be a continuation of the old Eureka ledge.

The Greyhound Company are pushing their tunnel and have a good deal of rock on the dump.

It is stated that work on the East Eureka will soon be commenced.

At the Greely and Blackmen work is going ahead as usual.

The Orleans mine is opened by a tunnel 2,500 feet in length. It has been worked more or less for thirty years past and has produced a large amount of bullion. In the future the mine must be worked to a greater depth, as the ore reserves above the tunnel are nearly all exhausted.

Nichols & Russell are still working at their claim. This is a very narrow ledge, but extremely rich. The rock is worked by a hand mortar, and is so rich that many thousands of dollars have been taken out during the past year by two or three men.

*Nevada City district.*—The mining of this district is confined principally to quartz. This class of mining has been prosecuted with unusual vigor during the past year. The probability that hydraulic mining will soon be among the things of the past in this county has caused a vast amount of prospecting to be done, as well as energetic work upon old locations.

The Providence mine is the leading quartz mine in this district, and in fact the leading bullion-producing quartz mine in this county at the present time. This mine, which is situated on Deer Creek, was located many years ago, and a vast amount of work done upon it year after year in sinking shafts and running drifts on the various levels without attempting to extract and reduce the ores to any great extent. The ore containing a large per cent. of sulphurets, the owners determined to do but little in the way of working it until they had a successful method of treating the ores. Thus the mine had been opened to a depth of 1,000 feet, and 14,000 feet of drift run, and no ore extracted, except from the three or four upper levels. Within the last three or four years, however, by the use of concentrators, the sulphurets have been saved and successfully worked. The shaft is now 1,200 feet in depth and it is estimated that there are 16,000 feet of drifts already run on the various levels. The ledge varies in thickness from 6 feet to 40, and even 50 in places. The hoisting works and the 40-stamp mill are run by water-power, and the labor-saving appliances are so complete in both mine and mill, that the ore is mined, delivered to the mill, and milled for $1 per ton. It is doubtful if there is another mine in the State of this magnitude where the entire work is done so cheaply as in the Providence. Since the 40-stamp mill was completed, over two years ago, crushing has been going on night and day, holidays and Sundays; not one of the stamps having been hung up at any time. About 95 tons of ore are milled every 24 hours, and a surplus of about 800 tons is always kept in the ore-bin. It is estimated by competent judges that sufficient ore is uncovered in the mine to keep the mill constantly running for ten years without further drifting.

The Nevada City quartz mine is also a valuable property. This mine is opened by a shaft 750 feet in depth, and the width of the quantity and quality of the ore seems to increase as depth is attained. The value of the ore per ton takes a very wide range, sometimes yielding only $6 and then running as high as $50. The mine has been steadily worked since 1879, and is now furnishing twice as much ore as can be worked in the company's 20-stamp mill. Good judges estimate that there is at least $500,000 worth of ore now in sight in the mine. Occasionally some very rich deposits are found, one piece taken out recently about the size of a man's head containing $600 in gold. The company intends to erect a new 20-stamp mill during the coming year, which, in addition to their present milling facilities, will place the mine on the list of the large bullion producers.

The Merrifield mine, situated on Deer Creek and adjoining the Providence, has been worked for years, but has not been very profitable to its owners, more especially of late. The mine was closed down last summer and partially filled with water, which not only injured the Merrifield, but, owing to connections with the Providence, caused the latter company much additional expense in taking care of the water from both mines. The mine was sold to a New York incorporation in October last, and was started up again about the 10th of November, and work has since been steadily going on. It is believed that the mine, if properly worked, will prove a valuable property.

The Wilson Ranch mine, which was purchased during the past year by Captain Hiatt and others, is on Deer Creek. There are four clearly defined ledges, all of which can be developed at good depth by tunnels from Deer Creek, which will be run. Shafts are also to be sunk. This has long been recognized as a valuable property, but a lack of means on part of its former owner has prevented its development. Those best acquainted with the location are firm in the belief that it will prove one of the best mines in the district.

The Murchie mine, which for many years had its ups and downs, has, by energetic and economical working, paid during the year its debts and accumulated several thousand dollars. It has long been believed that a rich pay-chute of ore existed in the mine. At the 700-foot level, the lowest depth attained by the shaft, this long-looked-for ledge was found. Since then work has been prosecuted to the west on the ledge, and it proves to have been a valuable discovery. The company owns two mills of 8 and 10 stamps respectively. The 10-stamp mill is run continuously on rock from the principal ledge, while the 8-stamp mill is used in crushing rock from other ledges that the company is prospecting. From present appearances the company will soon need additional milling facilities.

*Statement of the product of the Murchie Company's mines from* 1878 *to November* 30, 1883, *resulting from the work of the* 10-*stamp mill by steam-power.*

| Year. | Ore crushed. | Sulphurets saved. | Per cent. of sulphurets. | Gold product. | Sulphurets product. | Total product. | Yield per ton. | Cost of mining per ton. | Cost of milling per ton. | Total cost per ton. |
|---|---|---|---|---|---|---|---|---|---|---|
| | *Tons.* | *Tons.* | | | | | | | | |
| 1878 | 6, 332 | 263 | 4. 15 | $54, 344 74 | $25, 846 66 | $80, 191 40 | $12 66 | $7 15 | $2 10 | $9 25 |
| 1879 | 10, 103 | 538 | 5. 32 | 57, 393 65 | 111, 710 43 | 169, 104 08 | 16 73 | 6 93 | 1 89 | 8 82 |
| 1880 | 5, 924 | 254 | 4. 30 | 26, 313 07 | 49, 830 81 | 76, 143 88 | 12 85 | 6 85 | 1 52 | 8 37 |
| 1881 | 3, 505 | 150 | 4. 25 | 17, 209 55 | 44, 677 75 | 61, 887 30 | 17 65 | 6 19 | 1 67 | 7 86 |
| 1882 | 6, 240 | 240 | 3. 85 | 38, 064 11 | 61, 241 14 | 99, 305 25 | 15 91 | 5 88 | 1 57 | 7 45 |
| 1883 | 6, 372 | 276 | 4. 33 | 31, 665 48 | 68, 777 52 | 100, 443 00 | 15 77 | 5 41 | 1 52 | 6 93 |

NOTE.—The cost of "mining per ton" includes the dead work performed during the past six years. In the present condition of the mine, with water-power, the cost of mining will not exceed $3.50 per ton, allowing $12,000 per year for dead work. It will be observed that the product for 1883 embraces only eleven months of the year, and does not include a large batch of sulphurets now on hand for shipment.

The Mountaineer mine is situated on Deer Creek, about 600 yards from the Merrifield. The company has a 10-stamp mill, five of which are in operation day and night crushing rock from the mine. The ledge varies in size from 2 to 4 feet, and some of the specimen rock taken out is as rich as any ever found in the district. There are two ledges in the mine which seem to be coming together, and if such be the case it will be a valuable mine.

At the Banner mine work is steadily being done. It is being opened by tunnels and drifts run north and south from the end of the tunnel. A ledge shows in the south drift, and at times the ore found is very good.

The Sherman Consolidated mine has been worked during the past year, and at one time was expected to develop into a mine, but after sinking to a depth of 150 feet no ore was found that would average more than $3.50 per ton, while the expense of mining was about $600. All work therefore has been stopped and the mine dismantled.

At the Mount Auburn work has been steadily prosecuted by extending the various levels northward to connect with the old Johnson shaft, which is to be reopened, sunk deeper, and made the main working shaft. The hoisting works are to be removed thereto from their present location, as the incline through which the work is being done is believed to be too far south to admit of the best part of the claim being worked to advantage.

At Hamilton, a cave having occurred in McCormick's tunnel, through which he was working a ledge, thinking it cheaper to get rid of the *débris* by hydraulic process, he prepared a sluice and washed it away, when to his surprise he cleaned up about $1,000 in gold from the sluice, a portion of which was in good-sized nuggets.

*Canada Hill.*—Considerable quartz mining is being done in this district and the prospects are encouraging. Excellent ore is being taken from the Charonnet mine, the clean-up from one week's run of the mill being sufficient to pay a full month's expenses of mine and mill. Mr. Michel, of this place, has a patent amalgamating pan, through which he has been working some of the tailings from the Charonnet mill, and has obtained very satisfactory results. He realized $2.50 per ton from the tailings which were thrown away. The gold obtained is very fine, and is so light as to be floated away with the sand that comes from the mill. Mr. Michel proposes to put in two more pans below the mill and work all the tailings. He is confident that he can make it pay well for the trouble and expense of putting them in.

At the Franklin mine, in *Willow Valley*, a very rich strike has recently been made. The ledge, which has averaged about 3 feet in thickness, and been of high grade to its present depth (160 feet), where it measures 17 inches, is now showing richer than ever. From three tons taken out in one week, in sinking the incline, a portion of it was selected which is said to be worth $5,000 per ton. More of the ledge is now being stripped for extraction, and the richness shows no signs of abating on either side of the incline. Another level will soon be opened at a depth of 250 feet. The drift at the first level has been driven 100 feet along the ledge, and the end of the pay chute has not been found in either direction. The indications are now that the Franklin will prove to be one of the best mines in the district.

The Jackson quartz mine at this place is being worked in a small way and some ore has been taken out.

There are 50 tons of quartz to be taken from the Wide West mine, at *Canada Hill*, after which the present hoisting works will be torn down and new ones erected in their place. The shaft is down about 60 feet in the bottom of which there is a 1-foot ledge of good quartz. The owners of the mine are sanguine over their prospects.

The New Year quartz ledge, situated on Deer Creek, above the old Lecompton mine, is said to be looking well at present. A vein of ore 1 foot in width has been uncovered, and it is estimated that the rock will yield from $30 to $40 per ton. The mine is being worked through a tunnel that has been driven some distance into the hill, and the indications are that the body of quartz first encountered will prove extensive.

Thomas Hamilton & Co. have had a crushing of ore from their mine in Willow Valley, at the Deadwood mill, which yielded about $25 per ton.

At the Old Mack mine work has been resumed after a brief suspension. The incline, which is down 125 feet, will be sunk deeper. The pumps now in use in the mine are not powerful enough to handle the water and one of greater capacity is to be substituted.

The Buelon mine at Newton has done but little work during the past year. There are two ledges on the Buelon property. On the upper one, known as the Buelon Consolidated, a shaft was sunk 142 feet, a "horse" was encountered, and work stopped. The ledge in the shaft was about 20 inches wide and assayed as high as $250 per ton. By mill process, without the sulphurets, $20 in free gold was obtained. No work has been done on the upper ledge for about one year.

The South Yuba River Tunnel Company, at Hoyt's Crossing, have their tunnel in about 800 feet, leaving about 200 feet yet to run, which will require three or four months' time. The work is being carried on in both directions, diamond drills being used. The tunnel is 15 feet wide and 9 feet high. It extends the entire distance through hard granite. When finished, its owners expect to be able to work along section of the river bed, which is believed to be very rich in gold. The stream will be diverted from its natural channel into and through the tunnel.

The Nevada County Mining Company are well pleased with the prospects in their mine. A recent clean-up at the mine was very satisfactory and the chute of ore now being opened promises well.

S. Hethemyton's hydraulic mine at Nevada City has been in operation a portion of the time during the past season and has produced some bullion, but, like all mines of this class, has suspended. The mine has been worked about eight years.

Hirchman & Co.'s mine at Nevada City, which has been worked for seventeen years, had a short season's run and then closed down.

The Cold Springs mine is a drift mine which was operated about six months during the past year, but the gravel not being rich enough to be profitably worked, it has been shut down. Several thousand dollars were taken out the past year.

The Lincoln quartz mine has been worked at intervals since 1874. Previous to 1878 work upon the mine was confined to the surface. Since that time a shaft has been sunk to a depth of 130 feet on the vein or chute, and shows constant improvement as depth is attained. About 400 feet of drifts have been run, and the ore taken therefrom averages about $40 per ton. The rock is crushed at a custom mill.

The Marguerita hydraulic mine at Nevada City has been worked for several years, but with poor results until the present season. It is now richer than it has been for a long time. In places gold can be plainly seen scattered along the bed-rock, and recently several nuggets as large as walnuts have been picked up by the miners. The clean-up for the past season has been unusually large.

Lewis & Wheeler's hydraulic mine at Nevada City has been in operation during the past season and has produced well. The mine has been worked about twenty-four years, and would continue to produce well if allowed to work. During the past year water was not obtainable after July 1.

*North Bloomfield.*—The principal mine at this place is the North Bloomfield hydraulic mine. This mine has been worked for many years and has produced a large amount of bullion. The past season has been a successful one, and its productions fully equal to that of former years. It is the most extensive hydraulic mine in the county, employing a large force of men and using an immense quantity of water. The company owns their water used at the mines, which comes from reservoirs high up in the Sierras. There are several points along the gravel beds upon which water is used to wash away the detritus from the channel from which the gold is obtained. Some idea may be had of the enormous amount of *débris* coming from the mine, when a volume of water of 862,660 inches (miner's measurement) is used every 24 hours. The amount of bullion produced during the past season up to the 1st of February, 1884, at which time the mine was shut down by perpetual injunction from the United States circuit court, was $483,147.97. This amount was collected from the various sluices, undercurrents, &c., as follows:

| | |
|---|---|
| From No. 10 sluice | $311,885 68 |
| From No. 10 cut | 104,146 19 |
| From No. 8 sluice in tunnel | 2,574 06 |
| From No. 8 sluice in mine | 5,868 01 |
| From No. 8 cut | 2,129 39 |
| From undercurrents | 13,194 08 |
| From tail sluices | 3,708 75 |
| From cuts below the tunnel mouth | 1,792 25 |
| From 7,000 feet of tunnel between sluice and undercurrents | 21,749 14 |
| Quicksilver, cleaning tanks, &c | 16,130 42 |
| Total | 483,147 97 |

It has been said by parties opposed to hydraulic mining that this company has not earned much beyond the expense of running its mine for the past year. Such statements, however, cannot be correct, as the secretary's balance-sheet shows a net profit of over $300,000 for 1883. The total production of this mine since it was first operated is $2,829,869.59,

The second mine of importance at this place is the Derbec blue gravel drift mine. This mine has been operated for several years and has been a large producer. About two years ago the old workings of the mine seemed inadequate to the proper development of the mine, and bullion returns were quite meager. Through the advice of the superintendent, Mr. De Noon, a new tunnel was started and energetically prosecuted to completion, requiring about eighteen months' time; as a result of that labor the company now has a large and strongly constructed tunnel, 4,000 feet in length, through which the gravel is hauled in cars of about a ton each. About 250 loads of gravel per day are taken out of the tunnel; mules and horses being used for hauling out the gravel trains. When the gravel cars reach the mouth of the tunnel a large horse is hitched to them and hauls them up an incline track a distance of 700 feet, where the gravel is dumped into a "box," a structure about 80 feet long and about 40 feet wide, with a heavy wood floor sloping to the center through which runs the flume. At the end of the gravel box the pipe is held, and with a force of water washes the gravel into the flume and carries away the waste. The gravel is looking well, and the mine is on a good paying basis. The company employs about 60 men.

The Mankesha mine at this place has had a good run during the past season, but has probably closed down for good, and aside from the injunction against operating the mine, it is nearly out of "grader."

The Eureka drift mine has been worked since 1870, and has proved to be a valuable property. It has a tunnel 1,400 feet in length, employs six men, and produced well during the past season.

The Milton Hydraulic Mining Company owns several large rich deposits of gravel on the same ridge as the North Bloomfield, and previous to 1883 was the largest bullion-producing hydraulic mine in the State. In June, 1883, the dam of their reservoir gave way and precipitated its entire contents into the middle Yuba, carrying everything before it, and doing an immense amount of damage. Nearly all the flumes along the line of the miner's ditch belonging to the Eureka Lake Company were carried away, and miles upon miles of flumes along the San Juan ditch were utterly ruined. At the different mines along the river the damage was immense, and if the Milton Company is made to pay for the damages occasioned it will seriously affect their finances. The company has taken no steps to rebuild the dam and probably will not so long as the injunction holds against hydraulic mining. The product of the Milton up to July 1, 1883, was $248,633, and if the water supply had been continuous during the entire season, the product would have exceeded that of 1882, which was $500,000. The entire product of the mine up to January 1, 1884, was $3,412,509. The company employed about 160 men, all of whom have been discharged.

*Lowell Hill.*—This is quite an important place as a gold-producing point. Mr. P. M. Nilis writes concerning this district:

"Lowell Hill mining district is at the upper end of the long ridge that is between Bear River and Steep Hollow, and is on the great gravel belt that continues from Omega on the north through and beyond the Dutch Flat on the south. It dates back to 1850, when there was a lively camp here, supported by the many small claims and the river miners. The bed of Steep Hollow was exceedingly rich, and gold was found on the rim of the channel on the ridge at the grass roots. The front ground was only desirable in those days, and it was all appropriated by numbers of small companies or individuals, and when the rim was worked off the district was almost deserted for a few years. By degrees the small claims were consolidated and put into larger tracts of from one to three hundred acres, and Eastern capital now owns one-half the property.

"Commencing at the upper end and following down or westward, there are at present working in the district the Enterprise Mining Company, employing 22 men, and taking out about $600 per week; the Morgan mine, employing 6 men, running main tunnel and not yet in pay; Lowell Mining Company, employing 40 men; East New York Mining Company, employing 60 men; Dewey Mining Company, Planet Mining Company, and the Liberty Hill Water and Mining Company. These mines all extend back to the middle of the ridge, and each one is opened with a main tunnel in bed-rock averaging 1,500 feet, at a cost to each mine of at least $15,000. Every mine is well equipped with buildings, &c., and all have yet the bulk of their ground unworked. The Planet Company found their old tunnel too high, and are just starting one lower down, and have not reached the gravel. During the past year the East New York Company has been working a large force, but it would be impossible for me to state what they have produced. A safe estimate would be $45,000. The Lowell Hill Company, formerly the well-known Swamp Angel claim, is once more on a paying basis, with a large portion of the ground ahead of its present workings undeveloped.

"It is difficult to even estimate the amount produced by each mine, but I think $100,000 for Lowell Hill district for 1883 would be within the facts.

"Besides the companies mentioned there is a considerable amount of gold taken out of the cañons by the Chinese, who buy the tailings to work over. One sale of $4,000 was made to them last month.

"Across Steep Hollow is *Remington Hill district*, where there are three paying mines, besides several not yet developed sufficiently to pay. The probability is that during 1884 Lowell Hill will increase its production. Our gold here goes from 915 to 930 fine, San Francisco mint assays, where most of it is sent.

"The Lowell Hill Mining Company owns 228 acres of ground, and have worked about 10 acres, requiring eight years' time. It is a drift mine, and employs about 35 men, and pays well."

J. M. Barney says:

"*Lowell Hill mining district*, situated on the divide between Bear River and Steep Hollow, and about 5 miles north of Dutch Flat, is devoted entirely to drift mining, with the single exception of Liberty Hill Water and Gold Mining Company, which is an hydraulic mine. The main channel runs diagonally across the ridge, and is estimated to be about 1,000 feet wide, having a pay streak from 200 to 400 feet in width, and an average grade of 2 feet in 100. The pay gravel is not uniformly rich in gold, some places paying as high as $4.50 per car, and in others falling far below these figures.

"The Morgan mine, owned and managed by P. M. Nilis, is the most northerly of the group. It contains about 50 acres, and has been worked for a long time. It is conveniently fitted up, having dump, changing room, blacksmith shop, timber room, &c., under one roof. A large percentage of the gold taken from the mine is coarse nuggets, being found weighing from 2 to 5 ounces.

"Next to the Morgan, and joining it on the south, is the Lowell Hill mine (formerly Swamp Angel). This property has been worked quite extensively, at times upwards of one hundred men being employed. The gold, though not as coarse as that of the Morgan, seems to be more evenly distributed. This claim contains 228 acres, and is fully equipped with necessary buildings, cars, tools, &c., for the proper working of the mine. Mr. Robert Walsh, who has acted as foreman of this mine for a number of years, says it has produced $300,000. It is owned by Massachusetts parties, and is in charge of J. M. Barney.

"Still farther south is the East New York mine, containing 80 acres, owned in Dutch Flat. Their tunnel, which is 2,500 feet in length, through hard rock, tapped the pay streak only last year; since that time they have breasted with fair results. The owners are confident of large returns in the near future. The gold is quite evenly distributed, and about the same character as that found in the Lowell Hill mine.

"Next to the East New York are the Wild Cat and Wilkinson, in the order named. Neither of these claims is being worked. A tunnel some 2,000 feet in length was driven in the Wild Cat, but was found to be 40 feet too high, consequently not available.

"South of the Wilkinson is the Dewey mine, owned by San Francisco parties. There has been considerable money spent on the mine in driving tunnels and gangways, erecting buildings, &c. I think they breasted some last year, but at present it is idle.

"Opposite the Lowell Hill mine, on the Bear River side of the ridge, is located the Planet mine. The owners, after driving a tunnel some 2,000 feet and finding the bed-rock pitching away from them, consolidated with the Mule Spring, an adjoining claim, and started a new tunnel at the proper level. This tunnel will be large enough for a locomotive.

"The Liberty Hill Water and Gold Mining Company's property (hydraulic) is the most southerly of the group. This property has been worked a number of years, and is considered very valuable. Their water consists of three ditches running down the ridge, with a capacity of 2,000 miners' inches of water during eight months, and a half of that quantity for the remainder of the year. Two of these ditches take their supply from Bear River, the third from Steep Hollow. These ditches not only supply water for the company's use, but also furnish water for all the drift mines along the ridge.

"There are a number of claims that are worked occasionally, whose aggregate production adds somewhat to the output of the district.

"It is safe to estimate the annual output of the Lowell Hill district for the last year to be $120,000."

Wide West drift mine has a fine future before it, provided the courts do not enjoin drift mining. The mine was formerly worked by a tunnel 3,000 feet long, but this was abandoned in January, 1883. A new tunnel was commenced in April of last season and reached pay gravel in November, 1883, since which time work has been carried on through the latter.

The Remington mine adjoining the Wide West bids fair to be a big mine, and if allowed to continue work will prove a valuable property.

*Rough and Ready district.*—There are a number of mines located here, but none producing very largely.

The Black mine, Perkenpine, and Forlorn Hope have all been in operation during the past season, but have produced but little bullion.

The Iron Clad has infused new life into this vicinity by starting up its works. The old works have been pumped out and some excellent rock is being extracted from the 100-foot level and also from the bottom of the shaft.

*You Bet.*—The English company at this place recently started their new hoisting works at the Uncle Sam. Drifting has been commenced, and it is expected that the working force will soon be increased.

The Heyward Company are pumping out their mine preparatory to beginning operations for the winter. Both of the above mines are worked by the drifting process, and consequently are supposed to be free from injunctions. The gravel taken from the channel on which they are located is rich and the deposit extensive.

The Bird's Eye Creek Mining Company are operating extensively both hydraulic and drift; they have just completed a new 10-stamp mill for crushing the blue cement, which underlies their hydraulic mine. In the hydraulic season they operate four nozzles with satisfactory results.

The South Yuba Water and Mining Company have also a 10-stamp mill running profitably on cement; they also run three nozzles that pay well.

At Quaker Hill, 3 miles north, is the hydraulic and drift mine of Sargeant and Jacobs, worked by hydraulic and 10-stamp mill, which is a valuable property.

*Badger Hill.*—The English Hydraulic Mining Company here has been running during the past season with fair results. The mine has a tunnel 2,000 feet in length, and has been worked for twenty-eight years.

*Sweetland.*—The Manzanita hydraulic mine at this place has had a very successful run during the past season. A rich deposit of gravel was encountered containing a large per cent. of coarse gold, and although the season was very short the product was large. It is reliably stated that a clean-up of forty-one days' run gave $110,000.

At *Blue Tent*, the Yuba River Mining Company has been working as usual during the past season, and made a fine showing for the season's work. The mine is worked by hydraulic, and like all its kind is doomed. About 2 miles above this place F. Hathenway has commenced to open a quartz mine by running a tunnel parallel with and on the vein. The ledge is small, but shows many spots of rich ore. It is partially decomposed, and that portion is pounded out in a mortar from which several hundred dollars have been obtained, and the remaining portion of the ledge is put aside for crushing. The prospects are excellent.

*Washington district.*—Some considerable mining is being done here, both in quartz and hydraulic. The Giant quartz mine was originally owned by John Miller, and after his death was purchased by Messrs. Lewis and Blackman, of Sacramento. This is an immense ledge, and comparatively little work has been done upon it. At an early date, however, the company proposes pushing their middle tunnel forward until it cuts the ledge, and from that time they propose working the mine until its value is ascertained. There is every facility for working this mine cheaply. The company has its water conveyed in a ditch from near the head of Washington Creek to the mine, and will have a fall at the mines of 300 feet, and a sufficient quantity to run a 100-stamp mill, and any one who has ever seen the property will not deny that quartz can easily be secured to supply that many stamps. The ledge is, perhaps, one of the largest in the State, and the croppings can be traced for miles along the breast of the huge mountain this side of Washington, and a number of pieces of the quartz croppings show colors of free gold and sulphurets. It is the intention of the company to work this mine through what is known as the Middle tunnel. This tunnel will tap the ledge in 250 feet farther, which will make the entire length of the tunnel about 500 feet, and will give between 300 and 400 feet of backs. Quartz will be hauled through by mules and dumped into a chute and carried to the mill, which will be some distance below. The ground can be easily worked, and five men can supply quartz enough to run constantly a 60-stamp mill. Much of the croppings of this immense ledge is heavy with mineral, and as free gold has been seen in the quartz and good assays have been made from different portions of the ledge, it would be a singular thing if a large pay chute could not be found somewhere along the immense mountain of quartz. The surroundings of the ledge are good, being a hanging wall of slate and a foot wall of serpentine, below which is clay and then slate, and from the character of the country and the favorable situation of the property, it will cost but little money to determine its value.

The Yuba mine is another quartz mine, situated farther up the mountain, and is looking well. Several new and valuable improvements have lately been made by the superintendent, and rock is now taken from the mine and milled at an expense of $3 per ton. The 15-stamp mill is kept running night and day; 28 men are employed about the mine and mill.

The Alpha hydraulic mine is an old mine, and has been worked since 1851, and has always paid well. It is said to have produced over $1,500,000. The past year has been dry and short of water a portion of the time, consequently the production was not as great as some former years. Ten men are employed, and its prospects for the future are excellent if allowed to work.

The Omega Water and Mining Company is another important mine in this district that has been worked continuously for many years, and has produced largely. It is hydraulic, and has been in operation most the past year, turning out its usual amount of gold; but, like all other mines of this class, will in all probability be soon closed down. It has about 4,000 feet of tunnel, and employs about 20 men. It has been worked almost continuously for thirty years, and, if not closed down by action of the courts, can be profitably worked for thirty years to come, yielding from $30,000 to $50,000 annually.

The Hathaway mine, situated near the Omega, is also another important hydraulic mine. Very little bullion has been produced from this mine during the past year, owing to other work of importance having been done on the mine. About 900 feet of tunnel was run last year, thus rendering it available for successful prosecution of work for years to come.

From the H. M. Place, the Omega Company takes out from $40,000 to $60,000 worth annually. In previous years they have taken out as high as $125,000 worth in one season. The yield for 1883 was $2,200 worth of gold.

The Yuba River mine has a 20-stamp mill, but its production is not known.

*Morris Flat.*—This district has always produced large quantities of bullion from hydraulic mining. At present there is but one mine in operation, that being the Wah-Yen mine. It is owned and operated by a Chinese company, and has produced from $40,000 to $60,000 in bullion yearly for years past. It is still running, but will soon shut down.

## PLACER COUNTY.

The placer mines of this county were among the earliest discovered and worked in the State, and in permanence, richness, and gross aggregate of yield in the thirty-five years that have elapsed since they were first opened, they compare well with the mines of any other section of the State.

Placer County is peculiarly well situated for the development of deposits of its precious metals. The old overland emigrant road crosses the summit of the Sierras in the eastern portion of the county, and descending toward the Sacramento Valley, crosses the higher deposits of deep gravel that form the great drift and hydraulic mines, and then on to the lower foot-hills, reaching the extensive shallow placers worked by the more primitive mining methods. Sacramento City is the supply depot and starting point for all the mines of Northern and Central California. The main line of the Central Pacific Railroad runs through the county, rendering the greater portion of the mining districts directly accessible. Comparatively short wagon-roads from the railroad towns give communication with other mining sections.

The western part of the mining section consists of low rolling hills, intersected by numerous ravines and narrow valleys, lying between Bear River on the north and American River on the south, the highest elevation not exceeding 1,500 feet. The eastern portion is separated from the western by a comparatively non-mineral belt, about 15 miles in width, and consists of high ridges lying between precipitous river cañons. The northern of these ridges, or "divides," as they are locally termed, lies between Bear River Cañon on the north and the cañon of the North Fork of the American River on the south.

The mining towns of Gold Run and Dutch Flat, and the extensive placer mines in their vicinity, are on this "divide," which is traversed by the railroad. Between the North Fork of the American River and Shirt-tail Cañon is the Iowa Hill "divide," and between Shirt-tail Cañon and the Middle Fork of the American River is the Forest Hill "divide." These two unite above the sources of Shirt-tail Cañon, and together with several smaller and less important divides, joining on the south, where they lie between tributaries of the Middle Fork of the American River, and form one main ridge, which runs far toward the summit of the mountain, and is known as the "Forks House divide."

The geology of the mining districts is as follows:

In the lower foot-hills the country rock is granite. The line separating this formation from the metamorphic slates to the north and northeast comes from the American River, and running in a northwesterly direction passes about a mile south of the town of Auburn and 1 mile north of the town of Ophir, and finally disappears under the alluvial deposits of the Sacramento Valley. Shallow auriferous placers have been worked extensively all over this granite section, but are now entirely worked out and abandoned.

There is also one range of deep gravels, in some places capped with lava, commencing at a point about 1 mile west of Auburn and running thence southwesterly to a point about 12 miles southwest of Rocklin. These deep gravels seem to be the detritus of a very large dead river. They have been prospected and worked by drifting and hydraulicking at several points to be referred to farther on.

Along the line of contact between the granite and the slate, and in both country rocks adjacent to this line, are numerous auriferous quartz lodes. These lodes are most numerous, and the richest in the vicinity of Auburn and Ophir, and constitute the principal quartz-mining districts of the county.

Next to the granite, and extending from it to the higher altitudes of the Sierras, the metamorphic slates are the true country rocks. Through the western portion several strata of limestone occur, and through the middle and eastern portions diorite and serpentine strata are not uncommon. Dikes of porphyry also occur at one or two points.

A few quartz lodes have been found near Auburn that have been more or less prospected, but no mine has as yet been developed. Another group of quartz lodes is situated in the vicinity of Colfax. These are noted in detail farther on.

The central and eastern portions of the slate formation constitute the principal mining districts of the county. The river cañons have in this section been eroded deep into the slates.

On the summits of the ridges, between the cañons, are found the remains of at least two great trachytic lava flows, varying from a few feet to several hundred in depth. In some places the lava has been entirely eroded off, while others it seems never to have covered.

Lying between the slate and lava, and in some instances between two lava flows, are found the gravelly detritus of ancient buried river systems, varying from a few inches to 300 and even 400 feet in depth. These gravels are more or less auriferous, and have produced the greater portion of the gold yield of the county. The auriferous gravels, both as regards extent and richness, are found concentrated in lines of depression in the underlying country or bed rock, as it is termed by the miners. These depressions are evidently old river channels which, as a more correct knowledge of them is gained, seem to have been made by streams larger than those at present flowing through these grounds. Occasional quartz lodes are found, but the general character of the mines is placer.

The accompanying map of a portion of this placer-mining district will give a better idea of the relative position of the mining claims and the boundaries and extent of the gravel deposits. The shaded portions show the limits of the lava flow.

*Rocklin.*—Two miles east of this place is the Laird placer mine. This is the only placer mine in the lower foot-hills worked to any extent during 1883. The deposit worked consisted of old tailings and a few feet of top gravels. Sufficient fall cannot be had for working to any depth. A hydraulic elevator is employed to raise the gravel to the sluices. Water is obtained from the Bear River ditch. The mine pays well, the gravel being rich in fine gold. From 3 to 6 men are employed.

Directly south, and adjoining the Laird mine, is the Sacramento placer mine, in which the gravel deposit is the same as is in the Laird mine. It is worked by drifting from a shaft. Comparatively little work has been done, but still sufficient to prove the richness of the gravel.

Adjoining, and west of the Sacramento placer mine, is the Old River placer mine. It is opened by drifting from a shaft about 50 feet deep. The gravel is so cemented that it requires crushing in a stamp-mill to obtain the gold. It is not at present being worked, though one of the most promising mines in the district.

*Penryr.*—The works on the Chicago comprise a 200-foot shaft, with tunnels extending north and south from the 100 and 200 foot levels, together with hoisting works and a 10-stamp steam-power quartz-mill. Not much has been done of late, owing to certain improvements, such as the putting in of two Frue concentrators, but in a short time everything will be ready to start. A good body of ore is said to be in sight.

Five miles southeast of Newcastle is *Rattlesnake Bar*, on the American River, at one time an important placer-mining district. It is now, with the single exception of the Bowles claim, entirely given up to the Chinese.

The Bowles claim has been worked occasionally during the year and has paid good wages to a small force of men.

*Virginiatown* and *Gold Hill*, in Auburn Ravine, are entirely abandoned for placer mining, with the exception of what is done by Chinamen at the former place. Three miles north of Virginiatown, along the line of the granite and slate formations, are numerous quartz veins, several of which have been extensively worked, but are now abandoned.

*Auburn and Ophir.*—Commencing at a point about 2 miles north of the site of Gold Hill, and from there extending in an easterly direction to the town of Auburn, is a belt of country about 2 miles wide, full of quartz lodes, constituting the mining district of *Auburn and Ophir.* This district is in direct communication with the Sacramento and San Francisco Railroad, from Auburn, Newcastle, or Lincoln. An abundant and constant supply of water is available from branches of Bear River ditch. Oak and pine timber is plentiful, and at Lincoln there is an extensive deposit of lignite. The elevation being low, the winter climate is not severe. In every respect the district is favorably situated for economical prospecting and working of the mines. In 1872 and 1873 they were quite extensively worked, but, owing principally to mismanagement, they failed to pay, and until the last three years were in such bad repute that but little work was done on them. Owing to the developments made in 1883, they are again attracting attention, and several, under able management, are paying largely.

There are two classes of lodes in the district which differ in mineral contents and in the distribution of the contained gold. The more important of the two classes is in granite country rock. These ledges are from 2 to 6 feet thick, and regular in strike and dip, with distinct and well-defined walls. The ore-chutes carry usually large amounts of metallic sulphides, pyrite, galena, chalcopyrite, arsenite, stibnite, blende, tellurium, and selenium, in the order named. These minerals are collectively known among mill-men as sulphurets, and are usually rich in both gold and silver, the mill concentrations containing from $100 to $800 per ton.

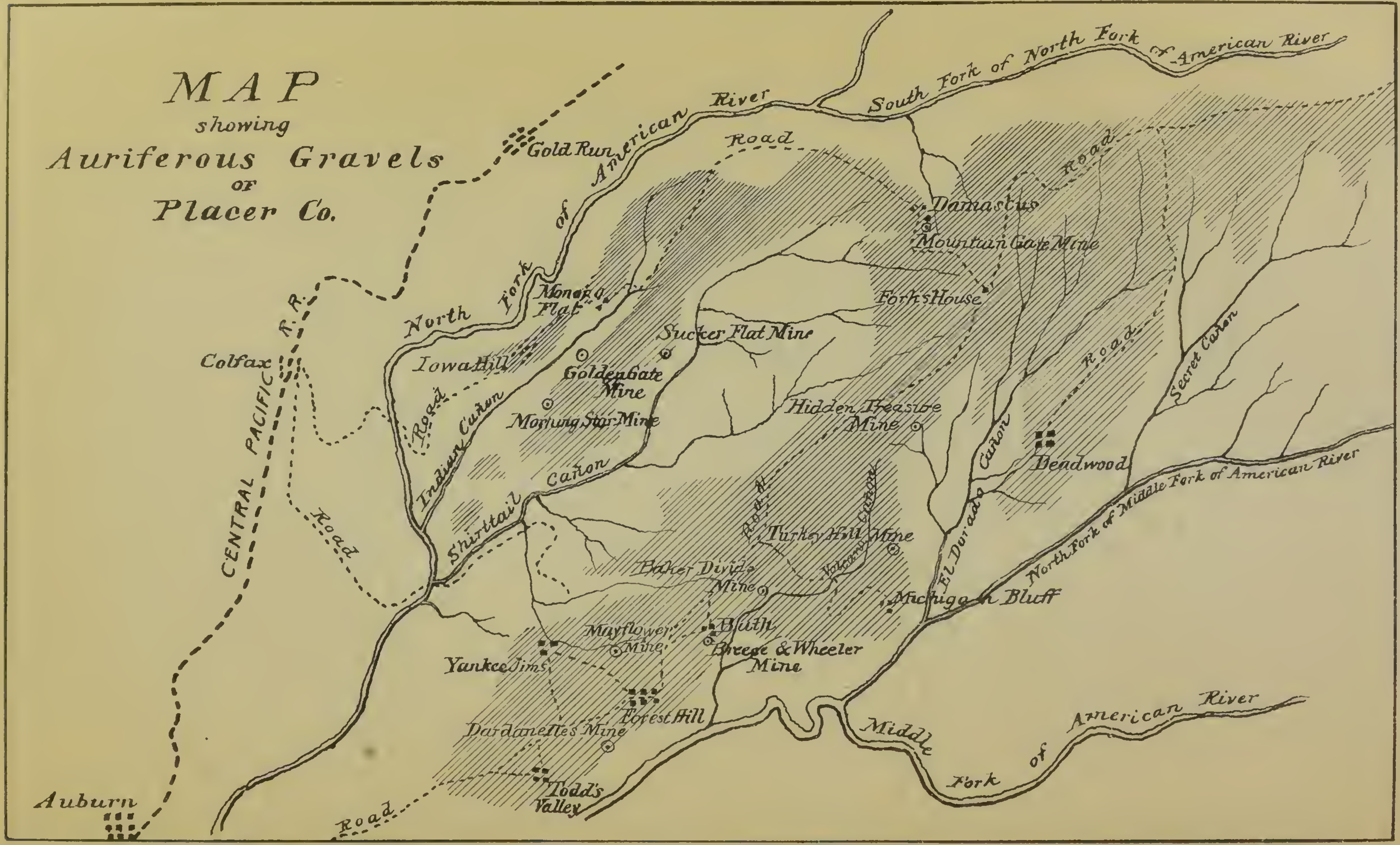
The ore-chutes are also very large and fairly uniform in the distribution of the gold, which, as a rule, is very fine and invisible to the eye. These ledges are distinctively "mill ledges," as contrasted with the second class of ledges, which are found in the slate formation. These, with a few exceptions, are numerous, and more or less irregular in strike and dip.

The sulphurets are not rich in gold, and the latter instead of being disseminated through the bulk of the rock in large chutes is more often concentrated into rich pockets. The mill plant required for this rock is a hand mortar.

At the western end of the district is the largest lode in the belt, and, from the developments already made, one of the most valuable.

At the northern end is the Belmont, one of two important mines located on it. On this mine the main shaft is down 220 feet, with several levels, exposing a ledge from 4 to 7 feet thick. The company owning it has recently erected a 20-stamp mill, the finest in the county. From 20 to 30 men are employed.

South of, and located on the same lode, is the Morning Star mine. This mine was first opened about 1870, worked for a time, and then abandoned. It was relocated about four years ago, and since that time has paid for costly development and improvements, and in addition paid large dividends. The main shaft is down 300 feet, all the way in high-grade ore. This chute of ore is about 200 feet long, and mills on the


MAP
showing
Auriferous Gravels
of
Placer Co.
Gold Run
North Fork of American River
South Fork of North Fork of American River
Road
Damascus
Mountain Gate Mine
Monona Flat
Forks House
Sucker Flat Mine
Colfax
CENTRAL PACIFIC R. R.
Iowa Hill
Golden Gate Mine
Road
Indian Cañon
Morning Star Mine
Hidden Treasure Mine
Road
Deadwood
Secret Cañon
Cañon
Shirttail Cañon
Road
Road
Turkey Hill Mine
Volcano Cañon
Baker Divide Mine
El Dorado Cañon
North Fork of Middle Fork of American River
Michigan Bluff
Mayflower Mine
Bath
Breece & Wheeler Mine
Yankee Jims
Forest Hill
Dardanelles Mine
Todd's Valley
Middle Fork of American River
Auburn
Road

average about $25 per ton. North of this, and 500 feet distant, is another chute of equal richness and greater length. This is opened by a shaft down 160 feet and another 100 feet, with several hundred feet of levels. Farther yet to the north, toward the Belmont, are still two other chutes of high-grade ore. In the 3,250 feet of lode are at least 1,000 feet of milling ore, ranging in thickness from 30 to 50 inches. Two hundred tons, taken from all points on the lode, yielded on milling $17 per ton. From 7 to 10 men have been employed. The work thus far done has been the opening of the mine by shafts and levels. The mine has recently been bought by an English company, which will soon put on a large force of men. A large gold production for 1884 is expected.

A mile and a half southeast of the Morning Star is the Gold Blossom mine, located on an east and west ledge. During the year 1883 extensive improvements have been made. A first-class 10-stamp water-power mill, and roasting furnace for sulphurets, and steam hoisting works have been erected. The main shaft has been sunk to the 200-foot level, and several hundred feet of drifts run, and a large amount of rock stoped out and milled. The ore pays in free gold, and carries a considerable percentage of high-grade sulphurets. The output of bullion for 1883 is large.

A few hundred yards to the northeast of the Gold Blossom is the Crater Hill mine, for many years the leading mine in the district. Like the Gold Blossom, it is on an east and west lode, and seems to be connected with it by spur lodes, although the character of the rock is entirely different. During 1883 the main shaft was continued from the 700 to the 800 foot level, developing, on the west of the shaft, an ore-chute before unknown, which, presumably, extends from that point to the surface. A level of 800 feet has been run and stopes worked from it. The ore is free milling, high grade, and carries a small percentage of very rich sulphurets. About 50 men are employed. The mine is equipped with steam hoisting works and a 15-stamp water-power mill; is now paying, and from every indication will so continue for years to come.

One-half mile east of the Crater Hill mine is the Belleview. The surface has been worked to a depth of about 100 feet by the owners, who have not the necessary capital to open the mine to a greater depth. It has, however, paid well. A company now has control of the mine, and new steam hoisting works have been erected and the shaft has been continued down into new ground, which, from milling tests made, is proving very rich. About 20 men are employed, and the prospects are that the mine will soon become an important bullion producer.

There are, however, hundreds of other ledges, and even more numerous mining claims, in the hands of men who, from lack of means, are unable to explore them. Some will, however, eventually prove excellent property. On nearly all of them a little work has been done; a few tons of ore are from time to time taken out and crushed at the custom mills in the district.

The mines already referred to are in the granite formation.

In the slate formation the most notable mines are the Shurtleff, Almatah, and Hunter, which have produced some bullion during the past year. The Conrad, Booth, Crandall, and Eckley are not at present worked. The approximate yield of bullion from the quartz mines of this district for 1883 is $225,000.

*Colfax.*—The Rising Sun mine, for many years the leading producing quartz mine of the county, having been shut down, there has been nothing of consequence done in mining at this point during 1883. The prospecting done is, however, very encouraging in its results. Several locations have been made on a large ledge, which milling tests show to be a paying body of low-grade ore. The developments made have attracted the attention of capitalists, and the mines are now in a fair way to be energetically worked.

*Gold Run.*—At this place and in its vicinity are immense banks of auriferous gravels, which have made the largest hydraulic mines in the county. Owing, however, to *débris* litigation, the hydraulic mines here have been shut down by injunctions. The gravels, though rich enough for working by the hydraulic method, cannot be successfully worked to any great extent by drifting. No developments of any consequence have been made during the year.

*Dutch Flat.*—This is the leading hydraulic mining district in the county; but, as at Gold Run, the *débris* litigation has practically caused a suspension of work. In the Hackey claims a body of gravel has been found that, worked by drifting, pays well. Aside from this, the condition of the mining industry at this point is unchanged from 1882. Immense bodies of gravel that can be worked at a profit by hydraulicking are yet untouched, and the most abundant and regular supply of water for mining purposes of any mining locality in the county is available.

*Blue Cañon.*—There is one unimportant hydraulic mine at this place, the Last Camp. It is worked about ninety days each spring, and pays moderately well.

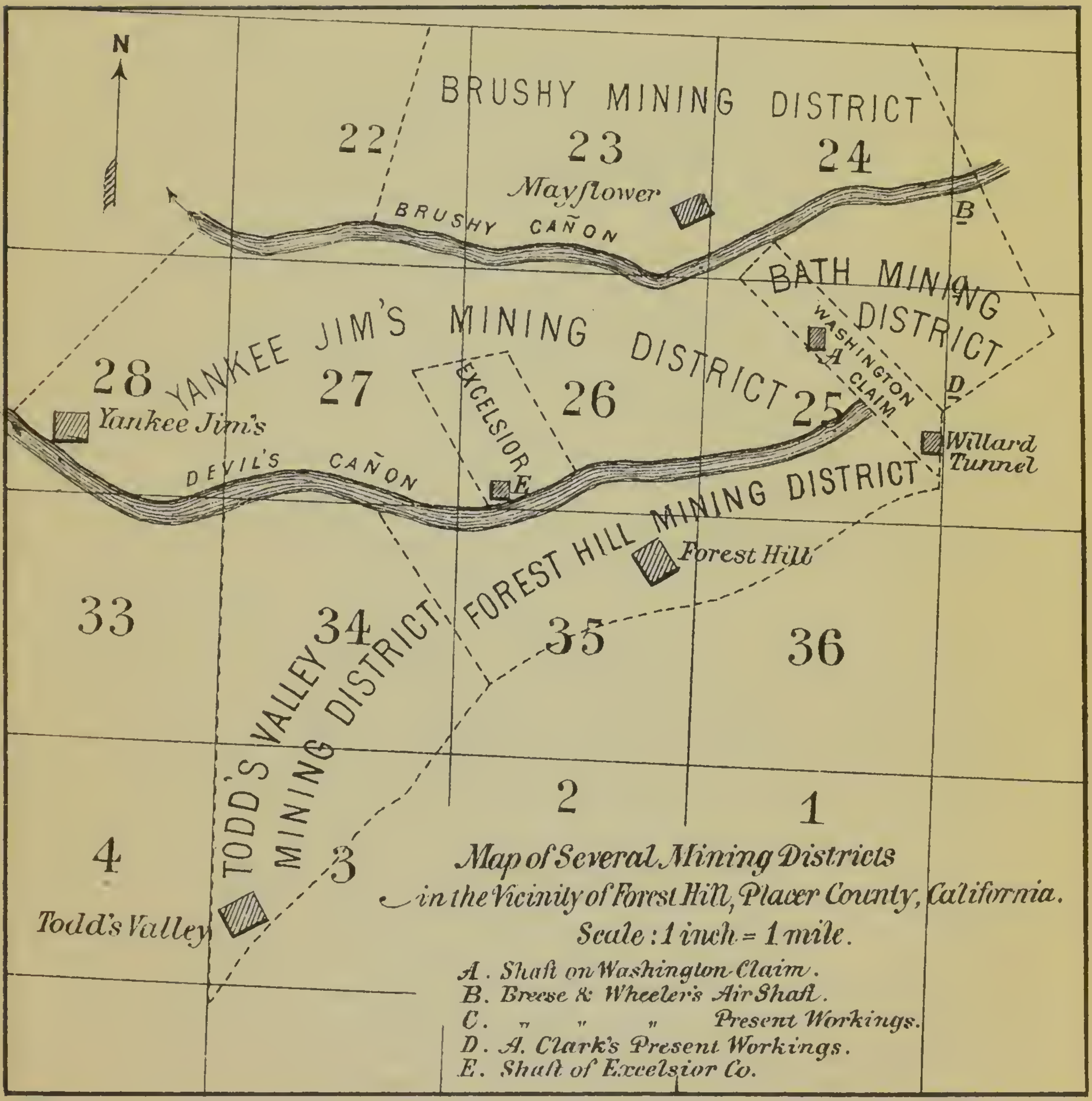
*Iowa Hill.*—This is a hydraulic as well as a drift mining locality. The ground on the Orion hydraulic mine on the south side of the town has been worked till the banks are too high for profitable working. A tunnel has been run from this portion of the mine under the town to the north side of the hill, which will be washed during the coming season. For three months 600 inches of water is obtained from the Iowa Hill canal. The prospects for an increase of gold yield for 1884 are excellent.

About 1 mile east of Iowa Hill is the Golden Gate hydraulic and drift mine. During the past season only hydraulicking has been done, but it is the intention of the owners, after one more season's washing, to work by drifting. The gravel is very rich, particularly in coarse gold. It is one of the most profitably worked mines in the district, and from every indication will undoubtedly prove for many years a paying mine.

Adjoining the Golden Gate, on the southwest, is the Morning Star drift mine, a very important and rich claim. It has for many years been a paying mine, and is at present being profitably worked. The gravel is strongly cemented, and has to be worked in a mill to yield all its gold.

About 1 mile east of the Golden Gate, and near Monona Flat, is the Strawberry Flat drift mine. Though the gravel in this claim is not so rich as in the two preceding, it is much more easily taken out. The front channel in the mine is being worked at present. During 1883 this mine produced considerable gold and paid well.

Two miles southeast of Monona Flat is the Sucker Flat drift mine, the most important mine in this locality at present worked. Its main tunnel is in 2,500 feet, running from which are numerous branches. Until the middle of August the ventilation was so imperfect that only 4 men could be worked. The completion of an air-shaft 325 feet deep has permitted the employment of a larger force. The channel in this mine, believed to be the same as the Golden Gate and Morning Star, is narrow but very rich in coarse gold, paying $20 per day to the man. Prospects are excellent for a continuation of this yield. About 16 men are employed.



*Map of Several Mining Districts in the Vicinity of Forest Hill, Placer County, California.*

*Scale: 1 inch = 1 mile.*

*A. Shaft on Washington Claim.*
*B. Breese & Wheeler's Air Shaft.*
*C. " " " Present Workings.*
*D. A. Clark's Present Workings.*
*E. Shaft of Excelsior Co.*

Other important mines are the Homeward Bound, Union, Pritchard, and Mohawk; all but the latter are principally worked by hydraulicking.

There are numerous other mines, at present idle or only working 1 or 2 men, prospecting. Some of them, lying contiguous to the at present leading claims, will in the course of a few years be opened up and prove valuable properties.

At Wisconsin Hill a number of hydraulic and drift mines have been opened and extensively worked. At the present time but little is being done, and there is little prospect of more in the future.

The more important of these mines are the Lebanon, Columbia, Hoorman, and Golden Streak; the former two are at present worked by Chinese, under a lease.

There is quite a promising quartz belt in this locality, on the Iowa Hill divide. Most of the ledges are in Hamburg Cañon, a tributary of the North Fork of the American River, heading at Damascus. The ledges are in slate country rock, strike nearly north and south, with a dip to the east. Many of them are very large, though the value of all but two of them is yet to be determined.

The Poor mine has been prospected by a tunnel, but is at present idle.

On the Pioneer two tunnels have been run in and have developed a 5-foot ledge of high-grade ore, besides numerous stringers and feeders.

In Shirt-tail Canon, near Sucker Flat, are two mines, the Providence and the Australian. On the former a tunnel has been run in on the ledge for about 100 feet. The thickness of the vein is about 5 feet, all in high-grade milling ore, very similar in every essential to the ore of the celebrated Hite mine in Mariposa County; a mill will soon be erected. The Australian adjoins the Providence, and is also worked through a tunnel. The owners have just completed the erection of a 10-stamp mill, and expect to immediately commence crushing ore. Both ledges are in diorite.

At Damascus is one of the largest and richest drift mines in the county, the Mountain Gate. During 1883 it was worked under great disadvantages. The main tunnel is in 7,000 feet, and through the first 6,500 feet of its course worked a channel directly above it. At this point another channel, 60 feet lower than the tunnel, crossed and cut away the first channel. Water and gravel have to be raised from this lower channel, now being worked. For this purpose the mine waters of the upper workings have been utilized by an overshot water-wheel 40 feet in diameter and 6,500 feet from the entrance to the tunnel. Great trouble is found in securing the practical working of the machinery. The gravel in the upper channel is white quartz, moderately rich in gold, but in such large quantities and so easily taken out as to admit of its being profitably worked. The lower channel is blue in color and of granite and slate origin. The gold is very uniform in size and fineness. At present 20 men are at work, all being owners in the claim. The annual output is not so large as in former years, owing to the difficulty of getting out the gravel. The returns from Damascus are as follows:

| Mine. | Ounces. | Per ounce. | Value. |
|---|---|---|---|
| Lewis & Griffith | 500 | $18 50 | $10,250 00 |
| Hayden Hill | 350 | 18 00 | 6,300 00 |
| Whisky Hill | 400 | 18 25 | 7,300 00 |
| Mountain Gate | 300 | 18 60 | 5,580 00 |
| Dam Mine | 625 | 18 25 | 11,406 25 |
| Total production | | | 40,836 25 |

*Butcher Ranch.*—This is a stage station on the road from Auburn to Forest Hill. On the Middle Fork of the American River, near this place, is a porphyritic country rock, containing numerous quartz seams carrying gold. The porphyry is washed by hydraulicking, and at times yields large amounts of gold. Two mines are being worked at present, the Whiteman and McKinsley & Gilbert. The water supply is very short, being principally the rain-water from the ravines near at hand. A few miles farther down the river is Mammoth Bar. The attempt to work the rich bed-rock gravel by drifting from a shaft having failed, the mine has been fitted up with a Cranston elevator, working under a pressure of 450 feet head of water. Four hundred inches of water is obtained from Georgetown ditch, in El Dorado County. From ten to twenty men are employed. The total expense of fitting up the mine ready for working was about $7,000.

Todde Valley.—The large claims of Pond & Co. at this place are being worked, though not so extensively as formerly, the best ground being worked out. In the winter the gravel is hydraulicked and in the summer it is drifted. These are the lowest mines worked on the Forest Hill divide. The prospects for the future are not encouraging, as in working 30 men the mine but little more than pays expenses.

Yankee Jim's.—The mining at this place is confined to a few small claims, of little present or prospective importance. None of the mines at present worked employ more than two or three men, and are operated only in the winter.

Forest Hill is at present and will for years to come, probably, be the center of the most active gravel-mining operations in Placer County.

The aggregate yield of the mines in this vicinity to date is estimated to be about $20,000,000, and though many of the formerly rich claims have been practically worked out and abandoned, new ones of equal extent and richness are taking their places.

At the present time the most important of the mines is the Mayflower, located about 1½ miles northwest of the town. For several years past a stratum of gravel on top of the cement has been hydraulicked, but has not paid regularly. During the summer of 1883 a shaft was sunk through the cement into a large deposit of channel gravel some 50 feet in thickness. Fifteen feet of this on the bed-rock is rich enough to pay for drifting, paying under repeated tests an average of $125 to the car-load. Preparatory to working this the company have erected fine hoisting works and a 20-stamp mill, both steam-power, at an expense of $40,000. The present and future prospects of the mine are excellent.

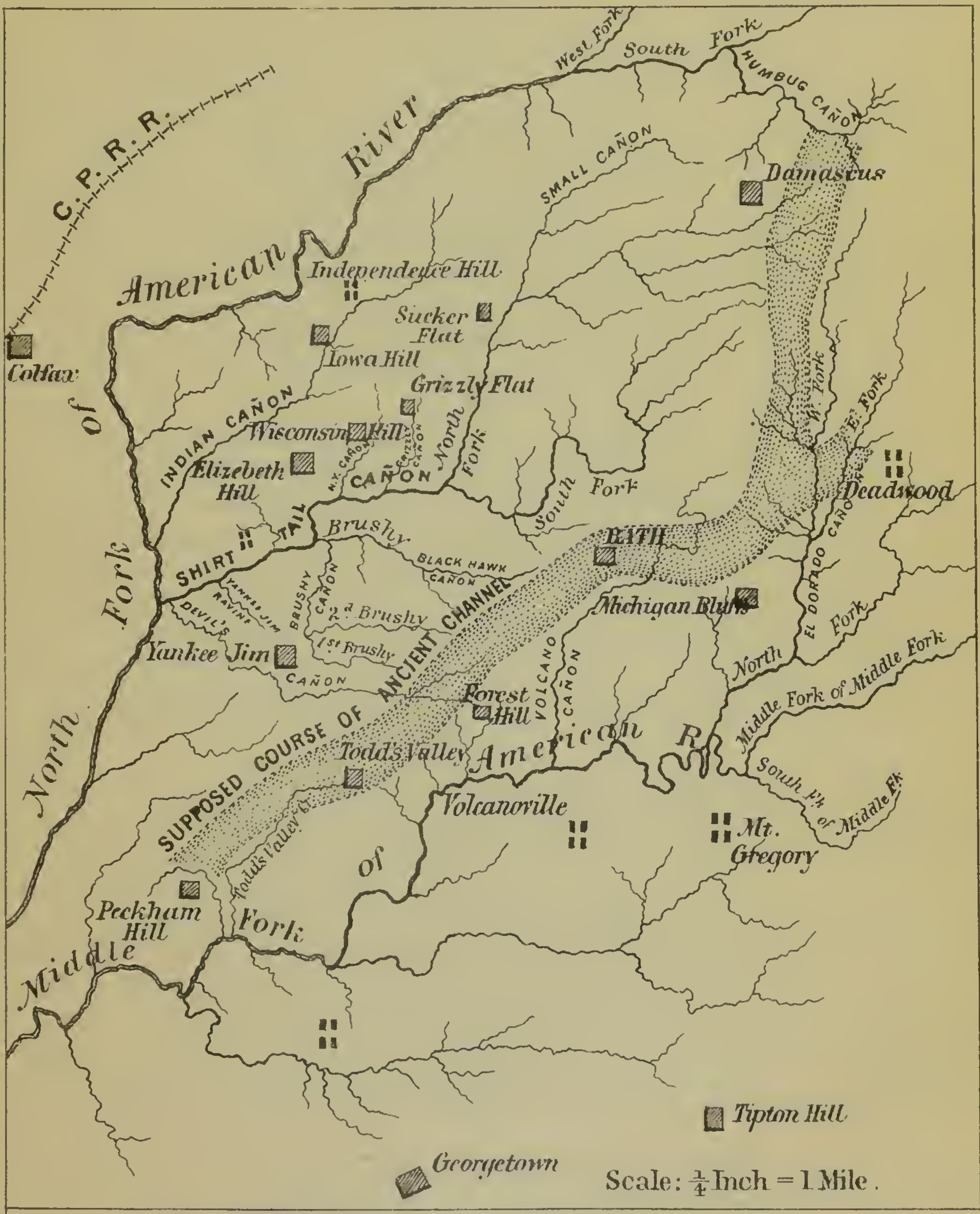
One-half mile north of Forest Hill is the Washington drift mine, at present being developed by sinking a deep shaft from the top of the ridge. Steam hoisting works have been erected, and all the work done is of the most thorough and permanent character. The shaft is now down 150 feet, and is expected to reach 400 feet before the pay gravel is encountered. Its prospects for finding rich gravel are regarded as excellent, as it will undoubtedly strike the rich channel worked in the Bath drift mines.

Other mines at Forest Hill are the following:

The Baltimore drift, employing 8 men, drifting hard cement gravel. It is paying well.

New Jersey drift claims, employing 4 men, at present working a back channel through a tunnel 2,500 feet long are paying.

The Dardanelles, hydraulic and drift mine, is the largest hydraulic and one of the most important drift mines on the divide, but was not extensively worked during 1883.



The Forest Hill Divide, Placer County, California.

San Francisco drift mine employs 4 men, running bed-rock tunnel.

Big Spring drift mine, adjoining the Dardanelles on the west, employs 8 men, and is a steadily paying mine.

At Smith's Point, about 2 miles northwest of Forest Hill, are the Adams and Cranage hydraulic mines. In the former 12 men are employed, and in the latter 4. For about three months every spring water is obtained from the Miners' ditch. Both are paying mines.

Bath.—At this place there are three very important mines, all worked by drifting.

The Breece and Wheeler, or Paragon, is one of the leading gold producers in the county. It is worked through a tunnel, in about 400 feet. Three pay lodes, one above the other, have been worked in this mine, all paying largely. The gravel at present taken out pays from $16 to $20 per car-load. From 16 to 30 men are employed. The owners have already accumulated large fortunes out of this mine, which will undoubtedly yield for several years to come.

The Orono drift is west of the Paragon, towards Forest Hill, and is opened by a bed-rock tunnel in 2,000 feet. It is on the same channel as the latter. The present working is on the rim of this channel. It is just being opened for extensive working. Eight men are employed. The mine is paying well, and the prospects are excellent for increased yield for 1884.

The Grinnell hydraulic and drift mine is between the Paragon and Orono, and is similar to them in the richness of the gravel. It is not worked very extensively at present, employing only 2 men.

Adjoining the east, and extending up and including the divide for 2 miles, is the Baker Divide drift mine. This mine has only been opened during the last three years, a small channel being worked by a tunnel in Vulcan Cañon. The main channel, the upper continuation of that in the Paragon, will be opened by tunnel from Shirt-tail Cañon, on which work will soon be commenced. When this tunnel is completed the mine will become very important. At present 10 men are employed.

Michigan Bluff.—The Big Gun hydraulic mine is the leading mine. The Breece and Wheeler ditch furnishes the water supply. The gravel is a white quartz, washing without blasting, and very rich for hydraulicking. The working force is 9 men.

The Turkey Hill or Weske mine is the only drift mine of importance. This is very completely equipped and opened by tunnels over a mile in length, necessitating the use of a locomotive to take the gravel out of the mine. The annual product of the mine is large, the force of men employed varying from 50 to 250, dependent upon the amount of pay gravel in sight. The area of ground yet remaining to be worked is very large, and includes the main divide for 3 miles above the Baker Divide claim.

Sunny South.—The Hidden Treasure drift mine at this place is another large and important mine, of the same white-quartz character as the Mountain Gate mine at Damascus, and though not yielding over $1 per car-load of gravel, is so extensive and easily worked as to make it the most profitable mine in the county. The main tunnel is in a distance of 4,000 feet, tracked the entire way with T-railroad iron. From 60 to 70 men are employed, and 400 car-loads of gravel are taken out every 24 hours. The outside plant for working is first class in every respect. The mine can be profitably worked for many years to come. Mr. H. Power reports the production of the Hidden Treasure mine as being, for 1883, $104,965.

One and one-half miles above Sunny South is the Dam claim, located on a blue lead channel; ten men are employed, and the mine is paying regularly.

Further up the divide is the Rainbow drift mine, similar to the Dam, but little worked at present, though undoubtedly a valuable claim.

At the Secret House, 12 miles up the divide, the only mine at present worked and paying is the drift mine. A new tunnel is being run to avoid pumping water from the mine. The prospects of this mine and the adjoining Hog's Back and New Basil drift mines are very good.

At Canada Hill there are several drift mines which are worked during the summer, and one or two quartz mines which have been located during the past two years.

Deadwood.—On this divide but little work is being done, and that is prospecting and running bed-rock tunnels in the drift claims.

The leading mine is the Golden Fleece, on the divide, several miles above Deadwood. This company has been prospecting for over six years, and in that time have run over 300 feet of tunnel. A body of pay gravel has been struck and is being opened up for work.

Pay gravel has also been struck in Hog's Back and New Basin, which, like the Golden Fleece, have been boring into the earth for years in the hope and expectation of striking the big blue gravel channel, or ancient river bed, the existence of which in the divide had been made known when tunneling and other developments were in progress.

The Ralston mine, at Pennsylvania Flat, 12 or 13 miles above Michigan Bluff, is a valuable property, from which rich returns are expected, as considerable quantities of rich gravel have already been taken out.

On Duncan Hill, Shurtleff is continuing his tunnel on the ledge, now in 615 feet. Several chutes of very fine sulphuret ore have been cut through.

Last Chance.—There are no mines of importance at this place, though some excitement exists over recent quartz discoveries.

From the foregoing it will be seen that, with the exception of the hydraulic mines at Gold Run and Dutch Flat (not at present being worked), the mines of Placer County have been moderately profitable during the year 1883, and the condition of the industry is fairly satisfactory. Hydraulic mining is, of course, at a stand-still, both from lack of water and the uncertainty of the future, but drift mining has been, and is now, producing a large amount of gold from all the mines in the county worked by that process. Several extensive works are projected for the opening up of large bodies of auriferous grades for drifting, and the permanence of this branch of mining seems assured for many years to come. Quartz mining, too, for the first time in many years, is in a fairly prosperous condition. Some new mines just discovered and several old ones reopened and worked, by steadily yielding large amounts of gold have done much to relieve the distrust with which, for the past seven or eight years, placer mines have been regarded by outside capital.

## PLUMAS COUNTY.

From various causes the mining industry of Plumas County was not pushed with as much energy in 1883 as in some former years, notwithstanding this county has been free from litigation between the farmers in the valleys below and the hydraulic miners; there being but few hydraulic mines in the county, and those so far from the Sacramento Valley that no complaint of injury has ever been heard. What local injury, if any, has been done by the hydraulic miners in Plumas has always been settled by agreement among the parties. No hindrance to mining was caused by disputes between miners and farmers during the past year, nor is any serious difficulty ever likely to arise between them. Without the market made by working the mines the farming lands of Plumas would be of very little value. Every new mine opened increases the demand for farm produce, and consequently enhances their value and the value of the land. Every farmer in the county is pleased to see mining operations begun near to or even upon his own land. Other causes, however, tended to check the activity of former years. A general languor followed the fever of speculating in mining property that had been so prevalent, and it became nearly impossible to induce capitalists to invest money for the development of mines. This arrested several promising enterprises in Plumas. Here, as elsewhere, the successful operation of the mines is dependent on the supply of water, and in 1883 that fell much short of the usual quantity. These are the chief, and, indeed, almost the only, reasons why mining in Plumas was not more vigorously carried on in the past year than any preceding year.

*Greenville district.*—The Antelope mine is a location which is being prospected at present, by running a tunnel to tap the ledge at a considerable depth below the croppings. The ledge has recently been reached, but not sufficiently opened to be able to determine the extent of the ore chimney either in length or width. Specimens of the ore show free gold, and the general character is favorable for the development of a paying mine. The property is owned by parties in Greenville.

The Arcadian mine is located in North Cañon, about 1 mile from Greenville, and on the Green Mountain Range. There are two locations owned by the same parties; the other is known as the Sunset. In both locations tunnels have been run, and the main ledge has been opened in each for a distance of about 200 feet; the ore is brown and works easily, very little powder being used. During the summer a 10-stamp mill was built, and run about six months till the water supply was exhausted. During this time ore was worked from both locations; the average yield was about $4.75 per ton, and the cost of mining and milling about $2.40 per ton. Since the mill was stopped, prospecting has been carried on with vigor, and a large amount of ore has been opened up. It is the intention of the owners to move the mill about 300 yards down the mountain side as soon as spring opens, which will be a better location and permit the working of the whole mine through one tunnel, as well as securing a much greater depth of backs in the upper part of the claim. There is good ground to expect that the Arcadian will become a lasting and valuable mine. It is owned by Greenville parties, some of them being thorough miners.

The Batchelder and Wing claim adjoins the Green Mountain mine, and has a 5-stamp mill run by water-power, which was run several weeks and paid very well, but the owners being embarrassed by debt were obliged to shut down. The property has since been sold under attachment and is now idle.

The Bullion claim adjoins the Antelope, and at present is in about the same condition. Both claims were among the first located in the district, but neither one has ever been thoroughly prospected.

The Crescent mine, with its 8 stamp mill, has been operated during a portion of the past year with varying results. The property also has a 24-stamp mill run by water-power. The mine is worked through a shaft, and hoisting and pumping can be done either by steam or by water power. About $60,000 has been expended in improvements, all of which has been taken from the mine. All work is now suspended at the mine, owing to a difference or dispute concerning the title to some of the property.

Gold Strife.—This old bullion producer has been running only a small portion of the time during the past year, owing to a lack of water supply. Prospecting bas been continued in the Bidwell tunnel, and lately some encouraging developments have been made. With a good supply of water the coming season the mine is expected to do a good season's work.

The Indian Valley mine comprises two locations, the Union ledge and the Indian Valley. The ore is raised 630 feet and sent to the 24-stamp mill of the company nearly half a mile distant; have both steam and water power, the latter supplied from the Round Valley reservoir, and work about 8 months in a year. The rock averages about $5.10 per ton, while it is claimed by the management that it costs $4.75 per ton to mine and mill it. The rock is very hard; the entire ledge requires drilling and blasting, the cost of milling and mining being reported at nearly double that of similarly operated mines. During the year legal proceedings have been pending between parties interested in the mine, bnt for this an air-compressor would have been in use, and the cost of taking out ore materially reduced. The legal proceedings are not yet ended, and not much improvement in the method of working the mine need be expected till the questions at issue are decided. But a small portion of the ground on either claim has yet been worked, and when contemplated improvements have been made this mine will undoubtedly be a good property.

During the past year very little was done at the Monitor mine. The mill was started and crushed a few hundred tons of ore, then shut down. A large amount of work has been done in this mine from time to time, but much of it was not well directed. Beyond question, the claim contains a very great amount of good ore that could be worked at a fair profit, but no profit has as yet been realized.

The New York mine has been idle during the past year, owing to the death of one of the owners. It is, however, expected that the mine and mill will soon be started up. The mill is of 10-stamp capacity, run by water-power from Round Valley reservoir. The ore from the mine is easily worked and cheaply mined. But a small portion has as yet been worked.

Rush Creek.—Along Rush Creek some prospecting was done during the year, but not much regular mining. Near the close of the year John Ellis did a few days' piping on a gravel claim, just enough to satisfy himself that he had found the lead, when cold weather compelled him to suspend. Mr. Ellis is satisfied that the ground will pay well, and will resume operations as early in the spring as possible. John Martin has been prospecting for quartz and feels much encouraged. Two or three other parties did some work along the creek during the year on small gravel claims, but do not know the result.

Providence Hill.—At this point some gravel mining was done during the year, but not to any great extent. Several tunnels are in progress on drifting claims, but none have yet reached pay dirt. At present work is suspended on most of them, but will be resumed in the spring.

Southern Eureka.—Nothing was done in this mine until late in the spring, when it was leased by John Taylor, who ran it only about three months. Mr. Leavitt, the representative of the New York owners, soon after ran a tunnel and intersected the ledge at greater depth. The tunnel was completed in December, and the mill started soon after, but the ore being of low grade and the expenses of milling so great, no profit was realized. The ledge is from 11 to 15 feet in width, and if cheaper and more extensive milling facilities were provided, it is believed that the mine would pay.

At the Taylor Plumas mine a mill was erected early in the year, but only ran a few days, when the water supply ran out and nothing further was done. The property changed hands during the last season. Some very rich ore has been taken out, and if opened up properly there is no doubt but a valuable mine will be the result.

Cherokee mine has been idle the past year.

In the Plumas Consolidated it is estimated that there is sufficient ore in sight to keep their 30-stamp mill running for six or eight months. The mill is provided with Frue concentrators, and all the appliances are first class in every respect.

At the Green Mountain mine the most important event of the year was the completion of tunnel No. 5 to tap the Blake chimney. The work was prosecuted with great vigor, power drills driven by compressed air being used, making 8 feet a day. About 300 feet of backs lie above this tunnel, which will furnish an immense amount of ore. The vein is from 10 to 20 feet in width. The company has two mills, but being run by water-power they were obliged to shut down for a good portion of the season. The largest yield from the mills during any one month was $16,300. The frequent stoppage of the mills and consequent loss sustained by the company from the short supply of water will probably cause steam-power to be put in. The property is owned by a New York incorporation and is valuable.

In addition to the above there are many other mines in the vicinity of Greenville upon which prospecting has been done, and in some a large quantity of ore is already in sight. Among these claims are the Garfield, Amora, Ophir, Yellow Jacket, Monumental, Crown Point, and several others, located on the Green Mountain Range.

The entire district is yet very imperfectly prospected, only three mines having been opened to any considerable depth, being the Green Mountain, Crescent, and Indian Valley. Only the first of these has been worked to any extent. In the mountain range that bounds the valley there is a vast deposit of iron ore. Specimens have been examined by Professor Jackson of the State University, and pronounced similar to the ore from which Swedish iron is made. In the same range are several copper ledges, some of them of great extent, and a very high percentage of pyrites, a material now imported from Spain in large quantities. At Greenville there is a hot spring, the waters of which have given permanent relief to persons afflicted with rheumatism and kindred diseases. In the north arm of Indian Valley, 16 miles from Greenville, traces of silver have been discovered, and are believed to be of considerable value.

Plumas Township.—The most extensive mining operations in this district are being carried on by Messrs. Agassis and Shaw, of Massachusetts, Prof. J. E. Mills having charge of the work. A shaft has been sunk in the center of American Valley, and bed-rock reached at a depth of 240 feet. The shaft was sunk by steam-power, using drills and pumps, and an iron tubing was forced down to the bed-rock. The water is being pumped from the shaft and drifts are to be run to prospect the ground. If the same should prove satisfactory, a tunnel is to be run from the mouth of Black Hawk to tap the shaft, a distance of about 2½ miles. It is one of the most gigantic mining operations ever inaugurated on the coast.

The Riverdale mine is located upon the O'Neil ranch. A shaft has been sunk to bed-rock and tunnels run, and some very good pay gravel found. The company, it is thought, are upon the old Elizabethton lode, which paid so enormously when worked in early days. The company has erected steam hoisting works, and there is no doubt but that the Riverdale will soon be a large bullion-producing mine.

The Elizabethtown Flat mine, owned by Loring & Leavitt, is being successfully worked; steam hoisting works have been erected upon the mine, and a large amount of gold produced during the past season.

The Last Chance mine is idle.

The Newton Flat, Nevada, and Deadwood Channel are all being worked with good prospects.

But little work has been done upon the Bill mine during the past year. This ledge has shown some of the richest pockets of gold-bearing quartz ever found in the district.

Weikle & Co. are running a tunnel on Emigrant Hill, and have found fair paying gravel.

Hawn & Co. are opening a promising quartz vein at Argentine, and will be prepared to take out and mill rock as soon as spring opens.

Clarmont Hill.—The Clarmont Hill Mining Company, Nos. 1 and 2, are English corporations, and are the owners of several extensive placer claims at this place. A large number of men are now at work taking out the gravel. The supply of water is short, and but little can be obtained for washing except in April and May.

On Hungarian Hill, Orr & Co. had a full season's run last year in their hydraulic claim, and the output was satisfactory.

Martin & Co. opened and worked their claim on Michigan Hill, and for the short time it was in operation it produced well. It is said that paying gravel has been struck.

The Texas Flat hydraulic claim was operated last season by the Blue Gravel Company, and the results were good.

Quartz Township.—The Valentine quartz ledge is producing some very rich ore. A small mill is in operation, and some of the ore assays up in the hundreds per ton.

The Bullion ledge, owned by Messrs. Hopgood & Wiseman, is being prospected with flattering results.

The Hawkeye, also owned by the same parties, has been opened and shows well. A new 8-stamp mill will soon be erected to work the ores from this mine.

The Truckee Mining Company has run a tunnel 600 feet in length to open a gravel bed, and have found some fine gravel, but the tunnel is too high to drain the water from the bottom of the channel.

Farther down the valley is the Wiseman & King claim, which has paid the last two seasons, although the water supply allowed them to work only a short time.

The Hansen gravel claim has been put in good shape for operations as soon as the water supply is available in the spring, and the owners look for a large yield during the coming season.

*Eureka Mills.*—At this place is the famous Plumas Eureka mine, which is by far the largest bullion producer in the county. The output of gold from this mine was over $400,000 during the past year, and apparently it has a great future before it.

The Little Jamison has a tunnel in about 400 feet, from which ore is being taken out to keep their 5-stamp mill in operation.

On the Roberts and Roach ledge a tunnel has been driven in about 500 feet and will soon tap the ledge.

The Garfield claim is a placer, and is being worked with fair results.

On Jamison Creek there are about twenty five arrastras, working tailings from the Plumas Eureka, and a large amount of gold is obtained from them.

On Mount Elwell a tunnel has been driven into the mountain, which has required two years' time to complete. Good rock has been found, and a mill is to be built the coming spring.

Meadow Valley.—No new quartz discoveries have been made at this place during the past season, but work has been pushed with unusual vigor on some old locations. The Diadem has driven ahead the tunnel of the Eagle Gulch level, which is now in 300 feet, and followed the ledge for the last 200 feet. The tunnel, when continued 450 feet farther, will give 300 feet of backs. At present it is in low-grade ore, averaging about $8 per ton, but, with a large body of higher grade quartz in the last cross-cut to the foot wall, estimated to work $30 per ton. Only a few tons of rich rock have been extracted during the past season, which has been worked by arrastras and hand mortars, but the company will build a stamp mill during the coming season.

On the southeast extension of the Diadem, Hansen & Andrews are prospecting their claim, which shows very well.

On the northwest extension the Honeycomb Company is running a tunnel into low-grade ore, resembling the Diadem, with good prospects.

Eagle Gulch.—There are several placer claims at this place, but have been idle the past season.

Meadow Valley Basin.—Work on a limited scale is carried on in the placer mines at Great Flat, chiefly by Chinese, but with profitable results. These mines are situated in a large basin at the confluence of Meadow Valley, Silver Creek, and Spanish Creek, of great depth, and filled with varying strata of clay, gravel, and volcanic detritus, the surface gravel only proving practically workable. Some five or six Chinese companies are at work in this locality. At the upper end of Great Flat, on the north bank of Silver Creek, Messrs. Hager & Co. have continued work on their gravel claim with very profitable results. The gold-bearing gravel is here about 10 feet deep, and generally rests upon a stratum of hard red clay, occasionally giving place to a coarse volcanic conglomeration. Mr. S. Taylor, owner of the adjoining claim, continues operations under difficulties, owing to lack of drainage and means of disposing of the tailings. The old channel of the creek above this claim, worked in 1852–'56, proved very rich, and all indications point to as good ground in the claim. A long line of 15-inch pipe has recently been laid to furnish water for a hydraulic elevator, by which means Mr. Taylor designs working his ground hereafter, when this valuable improvement will undoubtedly develop a very valuable property.

In the Golden Enterprise claim, situated at the lowest point of the Meadow Valley Basin, no work has been done during the year, and the great flume constructed with the design of furnishing an outlet for the Great Flat deposits has not been extended. The accumulation of tailings from the great hydraulic claims below seems to present a serious obstacle to the successful prosecution of this project.

Rich Gulch.—A very important discovery was made by Halstead & Co. at this place last season. The tunnel tapped the ledge showing a fine body of comparatively low-grade ore, worth from $6 to $12 per ton. An agreement has been entered into for the sale of the mine to the Plumas Eureka Company, and, if consummated, the company will erect a 20-stamp mill for reducing ores.

Whitney & Co. are running a tunnel to strike the famous French Ravine ledge at a depth of 250 feet from the surface. The tunnel has not yet reached the ledge.

*Light's Cañon district.*—The Lucky S. mine is a new discovery on the ridge above Light's Cañon. It is now owned by an incorporated company, and work is being vigorously pushed. Quartz miners who have examined the property pronounce it one of the best defined and most favorable looking ledges in the county. It is proposed to erect a mill early in the spring.

The Genesee mine is now stopped, but was successfully run during the past year, and will resume operations in the spring.

Tutt mine.—Considerable quartz has been taken from the Tutt mine and worked by arrastras, yielding about $15 per ton.

The Green Ledge and Centennial are being worked in a small way with arrastras.

## SACRAMENTO COUNTY.

This county is situated in the central part of the State, and is mostly adapted to agriculture, horticulture, and the vine, all of which industries are extensively pursued. There are, however, two localities in the county devoted exclusively to mining, viz, Folsom and Michigan Bar. The county contains 968 square miles, and nearly all the land is fertile and valuable. Sacramento City is the county-seat of the county as well as the capital of the State.

*Folsom.*—All the mines at this place are placer mines, many of which are worked by Chinese, the water being furnished by the Natoma Ditch Company. The waters from this ditch are also largely utilized for irrigation purposes. The Chinese produce large quantities of gold from this place, estimated by some to be $1,000 per day. Besides the Chinese operating here may be mentioned John Williams, John Mahoney, P. D. Eckert, and Donoven & Co., all of whom are working placer mines and producing well.

At *Michigan Bar*, on the Cosumnes River, are located several good producing hydraulic mines, which have been steadily worked for many years past. The water supply is obtained from the Cosumnes River by the Amador and Sacramento Canal Company, which take the water from the river, and after being used by the mines is returned again to the river. The Amador and Sacramento Canal Company have 1,700 acres of mining land here, and have worked steadily upon it for ten years past at an annual production of not less than $35,000.

The other claims operating here are the Martin Welsh, John Brown, David Upton, and James Jordan. These mines are all producing well, although in small amounts. The production by Chinese at this place is not large, perhaps not exceeding $500 per month.

## SAN BERNARDINO COUNTY.

San Bernardino is located in the southern portion of the State, bordering on Arizona and Southern Nevada, and is by far the largest county in the State, containing an area of 21,171 square miles. This county was comparatively isolated until the completion of the Southern Pacific Railroad along its southern border and the Atlantic and Pacific through the center placed it within easy and quick communication with populous centers. It is only within a few years that this county has had any prominence as a mining county, but the completion of the railroads has stimulated mining operations to such an extent that this county may soon stand in the front rank as a bullion producer. All the ores of this county are argentiferous and quite free from base.

*Calico district.*—This place is the most noted mining camp in the county. It is 480 miles from San Francisco by Southern Pacific Railroad. The mines are located on a sandy desert amid upheaved rocks barren of vegetation. Quite a similarity seems to exist between the mines of this place and those of Leadville, Colo., where the mineral veins often lie in horizontal beds, while here they are in both horizontal and vertical. One of these vertical veins has now been worked to a depth of 500 feet and still shows well in the bottom. Another mine, whose deposits appear to be horizontal and known to be 300 feet in width by 400 feet in length, has already produced $15,000, although it has not been worked to a greater depth than 20 feet. There are a large number of men at work in this district as chloriders and developing their properties.

The King mine has been worked during the past year by the Oro Grande Company, and has reached a depth of 450 feet, showing that the mine holds out as depth is attained. The ore has been transported to the mill by teams, a distance of 35 miles. Since the 1st of March last 400 tons have been hauled and milled, yielding $81.50 per ton. Had there been railroad transportation more than twice this tonnage could have been moved. It is estimated that sufficient ore is now in sight to last two years.

The Belle McGilroy Group is being opened by a tunnel now in 200 feet, cutting three bodies of ore of paying quantity. There are 400 tons of ore now on the dump, the value of which can be determined by the fact that 30 tons milled at the King mill yielded $125 per ton. This group is owned by R. P. Dyer and R. Gorman.

The Mozart Group adjoins the Belle McGilroy on the south and consists of the Mozart and Blue Blazes. Two shafts have been sunk, which show very rich ore, similar in appearance to that in the King, and assays as high as $300 per ton. About 40 tons are now on the dump.

The Shenandoah mine is still worked. The owners are now sinking a shaft in the ledge, which yields sufficient ore to keep their 5-stamp mill running.

The Garfield mine is producing ore of a high tenor. Thirty men are employed in and around the mine. Within the last few months about 300 tons of ore have been milled, yielding about $125 per ton, and a considerable quantity of sorted ore shipped to San Francisco.

The Oro Grande Company have recently purchased the 10-stamp mill of the Oriental Company, and will add 5 more stamps. The leading stockholders of this company have also purchased the Burning Moscow mine, which adjoins the great King mine, and will set to work to open it out in good style.

The Bismarck is looking well and shipping about 10 tons of ore per day, which averages about $100 per ton. The body of ore is about 400 feet long and 300 in width, and is constantly getting better as work progresses. This is what is known as a blanket ledge.

Messrs. Reed & Co., owners of the Humbug mine, say, "We have just sampled a lot of ore from our mine which is now on the dump and shows an average of $100 per ton. We now have 3,000 tons in sight and see no end or bottom to it. One hundred tons just milled netted $72 per ton clear from all expense."

The Kearsarge mine has been worked during the past season, and is yielding some very fine ore. The ore consists chiefly of rich chlorides and horn-silver worth about $200 per ton. This is a blanket ledge, but a 30-foot shaft sunk in the vein failed to show any bottom to it.

There are many other mines here being developed and worked with a profit. Among them may be mentioned the Sue, Josephine, Mountain Brow, Red Jacket, Mammoth, Runover, and others. Among the strikes recently made was one in the Bateman mine, the ore running up in the thousands per ton.

The Silver Odessa mine is being worked in an economical, business sort of a way, and is paying well, having produced about $40,000 during the past season.

At the Rock Point mine operations have recently been resumed, by driving a tunnel from the east side and running in the direction of the King mine. Some of the ore assays high, but the greater portion is low grade.

The Sam Houston is opening up a small vein of very rich ore.

*Waterman.*—At this place is located the Waterman and Porter mine, which has become quite famous as a bullion producer. About 60 men are employed in and about the mine. The owners are erecting new steam hoisting works over the main shaft. The mill, which is 3 miles from the mine, on the line of the railroad, is kept running day and night turning out large quantities of bullion.

*Providence.*—At this place, or more properly at Providence Mountain, is located the Bonanza King mine. This mine was discovered a few years ago, and has proved a genuine bonanza to its fortunate owners. The mine has been opened to a depth of 500 feet, with all the necessary drifts and winzes. The ore, which is argentiferous, yields $77.35 per ton in their 10-stamp mill.

*Ivanpah district.*—This is the oldest district in the county, and is located in the extreme eastern portion of the county. The principal mine in the district is the Lizzie Bullock, owned by Mr. Bidwell. Thirteen men are employed about the mine and mill, which is kept running on ore from his mine and a few others surrounding it.

## SAN DIEGO COUNTY.

This county is in the extreme southern portion of the State, and is the second largest county in the State, having an area of 14,968 square miles. The principal industries of the county are agriculture, stock-raising, and horticulture. The mining industry is confined to the following districts: Poorman's, Julian, San Jacinto, Cargo, Muchacho, and San Gabilan.

*Poorman's district* is situated about 60 miles north from the town of Yarra, and 10 miles northeast from Mesquite station, on the Southern Pacific Railroad. The ledges are a contact formation, having a granite foot wall and porphyry hanging wall, with a general trend northeasterly and southwesterly, being situated in a low point of hills extending to the Mesa Valley, lying between the Mesquite range of mountains, 5 miles to the north of the river range.

The mine upon which the most work has been done up to the present time is the Amelia mine, which has been opened to a depth of 150 feet by a shaft sunk on the foot wall, showing ore from the surface. At the bottom of the shaft a cross-cut has been run 40 feet, all in ledge matter, tapping the hanging wall and showing a 4-foot streak of green chloride, containing horn-silver.

The Merifee mine is situated about 40 miles from Colton, which is on the Southern Pacific Railroad. The shaft is down about 40 feet, and drifts have been run about 20 feet east and 35 west to a second shaft. For the amount of work done so far, the yield is surprising. Every sample taken from different points along the vein, when subjected to a test, showed a handsome prospect in gold. Everything indicates a true fissure vein. At the depth above mentioned, water was struck, and further work for the present delayed. The rock averaged $50 per ton, and increased in value as depth was reached. With the imperfect workings above alluded to, these gentlemen took out $9,500 in five months.

In the *San Gabilan district*, 25 miles from the Amelia mine, is located the Rosalia mine, on the east side of the San Jacinto Range, near the famous Temescal tin mines. Three shafts have been sunk, one to the west 45 feet, the second easterly about 35 feet, and the third, further east, is little more than a prospect hole, but still showing a substantial vein of rich ore. The walls are granite, which precludes the necessity for timbering, except where stoping has been done, at a point 20 feet westerly from the west shaft. The vein is from 6 inches to 4 feet in width. Numerous feeders come in at various points, all rich in gold, free and in chloride form. Through the center of the vein runs a rich streak of chlorides, which assays several thousand dollars to the ton. The mine now only awaits a pump to get rid of the water, and mill to crush the rock, to render it a source of revenue to its owners.

The San Jacinto mine, located on Good Hope ledge, has a vein ranging from 6 inches to 3 feet in thickness. Considerable work has been done in the way of opening the mine and taking out ore. Several stopes or inclines have been sunk, and ore taken thus far has averaged from $20 to $30 per ton. The company are now sinking on the ledge, and taking out $40 rock, and appearances indicate that this last chimney or chute of ore is more permanent than any previous one.

*Pinacate district.*—In this district is located the Gold Slate ledge mine, owned by Abram Hoag. It has been worked for several years, first by arrastras and later by a 5-stamp mill. The ledge between the walls is about 3 feet thick, the ore-body being made up of thin streaks of slate and quartz, the quartz carrying fine free gold to the value of from $12 to $20 per ton, but the slate in the ore body reduced the value per ton of the entire ledge to about $6. The workings are now down to water-level, and work suspended for the present.

Old Pinacate mine, which was bought in 1882 by Mr. A. Hoag, was worked to water-level during the past season, and gave ores ranging in value from $12 to $20 per ton, but is now closed.

Good Hope mine is situated near the center of the district, and was discovered by some Mexicans working placer mines near by. The rock is soft, mostly decomposed quartz, carrying free gold with a very little silver. The mine is developed by a shaft 220 feet deep, with drifts run each way from the shaft about 200 feet in length. About 500 tons of ore have been taken out and milled at the San Jacinto Company's mill, which yielded from $30 to $60 per ton. The mine is still hoisting ore.

The May Queen mine has a small lode; has been worked by arrastras principally. About 20 tons were crushed in the San Jacinto Company's mill, which yielded $6 per ton.

There are several small claims worked by Mexicans who crush the ores in arrastras, and only work selected ores. A short distance from the above place, on what is called the San Jacinto ranch, or more generally known as the Temescal Tin ranch, a good ledge was found and worked by some Mexicans, but they were driven off by the ranch owners, and for the past year the mine has been worked by A. Hoag, one of the ranch owners. The ore is hauled about 7 miles to his mill, and works about $60 per ton. The mine has a shaft 200 feet deep, but the ledge, like all the ledges in the vicinity, is small but rich.

The Shenandoah mine, near San Diego, has a shaft 177 feet deep and completed a 5 stamp mill in June last, since which time it has been in constant operation. The ore is free-milling gold, and in places very rich. The average of all rock worked last season was $32 per ton.

## SHASTA COUNTY.

Shasta County is bounded north by Siskiyou, south by Tehama, east by Lassen, and west by Trinity. The county extends 120 miles from north to south and 80 miles from east to west. About one-third of the county is auriferous, containing either placer or quartz mines, but the shallow placers have mostly been exhausted, leaving only the deep gravel banks and quartz ledges to be worked. The latter are almost innumerable, and those which contain gold and silver can be counted by the hundreds, although but a small number of them have been sufficiently developed to test their value as producers of mineral.

*South Fork district.*—This important district is situated in the western portion of the county, and contains a number of paying mines and others in various stages of development.

The Chicago gold and silver mine is the pioneer works of the district; its principal ledge is 3 feet wide, upon which one shaft has been sunk to a depth of 100 feet and another of 145 feet. Fifteen hundred feet of tunnels have been run and the greatest depth attained is 255 feet below the surface. The 7 stamp mill and roasting furnace belonging to the mine have only been run during a few months of the past year, owing to some litigation or misunderstanding among the owners, but from the rock crushed $80 per ton in gold and silver was obtained. There is in the district another mill of eight stamps and four arrastras, all doing good work and crushing ore for about six months of the year, which is reported by the owners to average $25 per ton.

*Sunny Hill district.*—This district adjoins South Fork district on the southwest. The bed-rock here is conglomerate or cement gravel streaked and seamed with talcose and copper slate, hornblende, and porphyry. A belt of this formation is 3 miles in width and extends a distance of 15 miles into the adjoining district of Bully Choop. The ledges here carry gold, silver, and some copper. The widest ledge is 5 feet. The deepest shaft in the district is 80 feet, and the longest tunnel 210 feet. The average pay from the five arrastras is $32 per ton.

*Bully Choop district.*—This large district lies on the western boundary line of the county and extends into Trinity County several miles. The bed-rock formation is similar to that of Sunny Hill district, but the ledges are of colossal dimensions, ranging from 4 to 40 feet in width. They carry gold and silver, the latter being most abundant. The ledges lie high up on Mount Bully Choop, a cloud-piercing mountain, the slopes of which are covered with a heavy growth of pine and fir, and down the sides of which run clear rills of water. Two small quartz mills and three arrastras, all run by water-power, constitute the machinery of the district, and all the machinery and material used there have to be packed over rough trails. There are about 40 locations recorded in the district, on most of which but little work has been done.

The Cumberland Consolidated mine is organized with a capital stock of $100,000. The ledge is 24 feet wide, and is tapped by a tunnel at a depth of 150 feet below the surface. This immense body of ore works $18 per ton, while the sulphurets are not reduced.

The Mammoth ledge is 40 feet wide, and lies 6,500 feet above the level of the sea. The last 113 tons of ore taken from this ledge paid $41 per ton, and was worked in an old mill, the very appearance of which is a burlesque on modern mining machinery. The great need of the district is adequate machinery, as at present nearly all the fine or flour gold sulphurets are wasted.

The Big Central mine has a 4-foot ledge, in which a 150-foot tunnel has been run and from which $20,000 has been taken.

In *Round Mountain district*, in the northern part of the county, the only mine developed to any extent is the Afterthought Consolidated. This mine appears to be one vast ore-body, and is partially pierced from the mountain side by three tunnels, each of which is over 140 feet in length, but neither of them has cut through the ore-deposit, which yields principally silver, but contains some gold and copper. The mine is supplied with a 10-stamp mill and a copper-smelting furnace. The ore averaged during the past season $34 per ton. In addition to the ore reduced at the mine, shipments made to Swansea, Wales, yielded $410,000, and paid at the rate of $37 per ton. The mill has been temporarily shut down, owing to some difference among the owners in regard to its management.

*Shasta district and vicinity.*—The following mines are located in Shasta district and within a few miles of the county capital: The Eastern Star, 2½ miles east of town, has a 4-foot ledge, on which a 60-foot shaft has been sunk and a short tunnel run. The main ore-body, worked in an arrastra pays $17 per ton, but a very rich vein of free-gold quartz runs through the ledge and varies from 1 to 2 inches in width, which, pounded up in a hand mortar, pays at the rate of $14 per pound, and one nugget found was worth $126. Near the White mine, on Salt Creek, is the Kempton ledge, a narrow but rich free-gold ledge, which yields about $110 per ton. On this mine is a small quartz mill, run by water power, and when not in use on ore of its own mine it is kept busy on custom ores. In this vicinity great activity is manifested in hunting for pocket mines. During the past year some twenty of these pockets have been found, which have paid from $100 to $11,000; while Z. W. Zent found in three days ore that paid $2,400.

At *Flat Creek* the Murray claim has a 460-foot tunnel, which taps the 3-foot ledge 100 feet below the surface. This quartz, worked in an arrastra and a small mill, pays $75 per ton. The Ten Eyck Brothers have an equally good paying ledge in the same locality, on which an 85-foot shaft has been sunk and a long tunnel run. There are also several other ledges on this creek, which pay their owners good wages by working the rock in hand mortars.

On Backbone Creek an immense ledge, extending 5 miles, has been discovered, and a new district organized.

*Backbone district* is situated at an altitude of 6,000 feet, and the stream that runs through it, as well as the district itself, derives its name from the great rocky ridge in which the mines are found. The California and Oregon Railroad runs through the district, also the Sacramento River. The claim on which the most work has been done is owned by John L. Cook & Co., and they possess the capital necessary to develop the mine. The width of the ledge is still undetermined, though a tunnel of 160 feet has been run in without cutting it. From the mouth to the end this tunnel runs through solid ledge matter which is believed will pay for reduction, but near the end of the tunnel the ore rapidly increases in value and assays $40 per ton in silver. Another tunnel is being run by the same company on another claim, who expect to tap the ledge at a depth of 800 feet. Twenty tons of ore found in the clippings of the Snow Peak assays as high as $5,000 per ton, and in some portions of it native silver is found. Work is being energetically pushed upon a series of claims owned by W. W. Nichols & Co., and the prospects are very encouraging. There are also many other locations on this mammoth ledge, mostly owned by men who have no means to develop them.

*Iron Mountain district.*—This district adjoins Backbone Creek district on the south, and lies 8 miles north from Shasta, and, like the adjoining district, the California and Oregon Railroad and Sacramento River run through it. The district is over 5 miles in length, and takes its name from a rugged mountain which lifts its head to an altitude of 7,000 feet above the level of the sea.

Across this mountain, and extending through the district is one of the most colossal and remarkable bodies of silver ore yet discovered in this part of the State, and it may also be remarked here that the immense ledge that traverses Backbone district is generally supposed to be but a continuation of this vast silver dike. For 110 yards this ledge crops out naked above the surrounding formation to a height of from 30 to 50 feet.

The Lost Confidence mine, the original discovery claim, owned by Camden & Co., extends 1 mile along the ledge. Two tunnels have been run into this ore-body, but neither of them has gone through it. The upper tunnel is in 140 feet, and 75 feet below a second tunnel is in 300 feet and connected with the upper one by a shaft which descends all the way through a solid body of silver ore. No reduction works have been erected on the mine, but the company have built a wagon road to Shasta at an expense of $10,000, and are shipping ore to San Francisco which pays from $75 to $100 per ton, while some selected lots have yielded $4,000 per ton.

The other claims in the district upon which work is being done are the Potter and the Emma Consolidated, both of which prospect equally as well as the Lost Confidence.

At Whiskytown, 6 miles northwest of Shasta, there are several good paying quartz mines. One hundred tons of ore from the Marion paid $83 per ton.

The Phœnix mine has a 10-stamp mill, purchased and consolidated several mines, and are working all of them with fair results.

The Williams placer claim, in the same locality, has paid the past season at the rate of $275 per month to the hand by hydraulic method.

The Hardscrabble hydraulic mine at Piety Hill has about 40 acres of gravel from 6 to 35 feet deep, runs two giants, and works about 20 men during six months of the year.

The Tom White gravel mine, near the Hardscrabble, works fewer men, but is said to pay largely.

There are many other gravel claims in different portions of the county which are worked by individual owners during the rainy season only, but do not warrant a detailed statement. The bulk of the gold now taken from the placer mines and the bars and flats along the streams, is mostly by Chinese, the aggregate amount of which cannot be determined with any degree of accuracy.

At Mad Ox Creek, near Whiskeytown, is situated the George Hearst mine and a 10-stamp mill, which is a good paying property. The mine has been worked to a depth of 390 feet, and the ore pays steadily at the rate of $20 per ton. The ledge has an average width of 3 feet, and yields free gold at a cost for mining and milling of about $2.50 per ton.

At the Tower House and French Gulch, in the northern portion of the county, are several good paying quartz mines, supplied with small mills, but the owners do not seem inclined to have their workings reported.

At Old Diggings, 12 miles northeast from Shasta, Frank Young & Co. found quite a bonanza in the shape of two free-gold quartz ledges. The ledges run parallel, 25 feet apart, and crop out 4 feet wide for a distance of 80 yards. A shaft sunk on one of these ledges 60 feet deep has yielded quite a fortune already. The quartz is so rich and finely impregnated and wired together with gold that it is the intention to send most of it to New York and Europe to be manufactured into quartz jewelry and other ornaments.

Mr. S. F. Southern reports that from the placers at Hazel Creek, Moro Creek, Ida Creek, and Portuguese Flat a few thousand dollars were taken out. Moro Creek has just been discovered. Most of the gold taken out of this district is coarse, but contains more or less quartz. There is a vast section of country here which is unprospected. This district is on the line of the proposed California and Oregon Railroad.

## SIERRA COUNTY.

The western boundary of this county is in the high foot-hills of the Sierras, just where they commence to be called mountains. The main watershed of the mountains crosses the county towards the western end, so dividing it as to leave two-thirds to the east. This portion, draining towards the inland basin of Nevada, consists of high plateaus and mountain valleys, crossed by spurs of comparatively low hills, coming from the main mountain axis, and is in spots fairly fertile and productive. From it comes a large proportion of the supplies used by the mines on the western slopes of the county. The portion of the county west of the mountains would be almost valueless but for its mines. Its only other product of commercial value, its timber, is too inaccessible for other than local use. The surface of this portion is broken and rugged in the extreme. The Middle Fork of the Yuba is the south boundary of the county, and the several forks of the North Fork of the Yuba, running nearly parallel to this, through tremendous mountain cañons, divide this western section into high, sharp ridges, again cut into by the numerous tributaries of the large streams. This peculiar topography has made the intercommunication between the several mining sections very tedious and difficult. There are but few direct roads, trails taking their place. Two roads only provide access to the mining towns from the outside: One from Comptonville, just over the line in Yuba County, runs up the southern ridge or divide to the Mountain House, and there forks, one branch going to Forest City, Alleghany, and Minnesota, the other to Downieville and Sierra City. The other road comes from Oroville, in Butte County, up the Northern divide, and leads to Scales, Howland Flat, Gibonsville, Saint Louis, and Port Wine. The bringing in of supplies is very expensive, and is only practicable in the summer months, owing to the heavy fall of snow in winter. Geologically the county is similar to Nevada County on the south. The central mountain axis is granite, extending a considerable distance to the west, where the auriferous slates commence and continue to the western boundary. East of the summit basaltic lavas cap the country rock almost to the summit. To the west of the summit, sometimes overlying the granite, but more often the slate, and capping the divides, is a lava flow of a different character, similar to that found in the other mining counties on the western slopes of the Sierras. The erosion of the present streams seems to have carried away a larger portion of the original lava flow than is the case with either Nevada or Placer County. Underlying this lava flow in the depressions of the country rock made by the ancient river system of the country are the auriferous gravel beds that constitute the drift and hydraulic mines. The area of lava surface being comparatively small, so also is the surperficial extent of auriferous gravels.

The northwest corner of the county, in which are the towns of Howland Flat, Gibsonville, Scales, Saint Louis, and Port Wine, is the principal section—a small area.

Eureka North, now nearly worked out, a small section at Brandy City, and the divide between the South and North Forks of the Yuba, on which are Forest City, Alleghany, and Minnesota, comprise all the area containing gold placers. Quartz mining is the leading industry in the vicinity of Sierra City and Downieville, and to some extent of Minnesota and vicinity.

Owing to the roughness of the country, and its comparative inaccessibility, mining is prosecuted under considerable difficulty and at great expense. To counterbalance these disadvantages, the gravel deposits are rich and very extensive, that is, the channel and pay lodes are wide wherever mined, and the quartz lodes are larger and contain more permanent pay ore than do the ledges of many others. The mining work of 1883 has been very satisfactory to the mine-owners, and the outlook is encouraging.

*Gibsonville.*—The Union Consolidated mine at this place has paid very well. The main tunnel has been pushed in a distance of 4,000 feet to the back channel. It has been found to be 30 feet too high, so that the ground has been worked under difficulties through an incline. There is a considerable flow of water, which, as well as the gravel, has to be raised by hand, making the working exceptionally expensive. The gravel pays from 6 to 8 per cent. lead.

The Nevada hydraulic mine paid well during the season. One quartz bowlder was taken out, weighing 165 pounds, yielding $2,500 in gold.

At Hepsidam, up the divide from Gibsonville, the Niagara Consolidated Company have their tunnel entirely through the ridge. Gravel that pays $2.25 per car-load has been found, which can be profitably worked, considering the slight expense of getting it out.

The Fairplay hydraulic claim made a successful run, though several weeks short of its usual water supply. Much of the richest gravel yet remains to be worked. It is said to have produced $22,000.

Scales Diggins.—The Cleveland Company were hindered in working their claim through a deficient water supply. For the time worked it paid largely.

The Union Hill hydraulic was also profitably worked during the season.

Poverty Hill.—The Gold Valley hydraulic mine paid well for the short season worked, but a new tunnel must be run before reaching the richest part of the channel. The work on Lucky Hill of pushing the main tunnel has been stopped for a while.

The Cleveland hydraulic, the Union Hill, and the Rock Creek tailing claims have produced, respectively, $13,000, $18,000, and $5,000.

Howland Flat.—Drift mining is carried on extensively at this point, and the year's work has proven very profitable. No new strikes of any importance have been made. The Table Rock Mining Company produced $10,765.

In the hydraulic mines of this section large numbers of Chinese find employment. They are to some extent also employed in drift mining.

Brandy City.—Three hydraulic mines at this place have been worked during the year.

The Brandy City is the leading claim, and employs 40 men all the year round, and has a constant supply of water. The gravel this year has not been so rich as formerly, but has paid well. The surveys have been made for a tunnel a mile long and several hundred feet run. Burleigh drills are used. The ground to be opened by the tunnel is supposed to be very rich.

The Arnott claim has also been worked and paid during the year, though handicapped by having to purchase water.

The Grizzly Hill claim, after many years of preliminary work, is in a condition to commence profitable operations; notwithstanding a short water season in 1883, a fair clean up was made.

The following are the returns from this district: Arnott & Co., $31,690; Brandy City Mining Company, about $30,000; A. & T. Sharpe, Grizzly Hill, $6,000; Philip Fendingham, Tail Creek, from Arnott's claim, $2,100; John Williams Creek, also from Arnott's claim, $1,600; Peter Mondada, tailing claim, about $1,600; other small claims, about $200.

A gold-bearing quartz ledge has been found on Cherokee Creek near Brandy City. The lode is very large and prospects well in free gold. Assays made went as high as $160 per ton.

Pike City.—This is at present quite an important mining camp.

The Alaska, the leading mine, that yielded so small during the latter part of 1882, had a set-back early in the year, through the burning of its hoisting works, and consequent suspension of work. The hoisting works were immediately rebuilt, and upon their completion work was resumed. The mine employed 70 men. The indications for a large yield from the ore-bodies already opened are very favorable.

The Grizzly quartz mine, near the Alaska, is one of the oldest locations in the country. Besides rich masses of specimen rock, the bulk of the ore seems to be of an excellent milling grade. The mine is being reopened by a tunnel from Texas Ravine that will open the ledge to a considerable depth below the present workings.

Mountain House.—There have been no new developments at this place during the year.

The Brush Creek quartz mine has not been worked, and but little quartz prospecting has been done. In all probability there is a channel of pay gravel in the ridge between the Mountain House and Comptonville, but through lack of means the companies owning claims on it have failed to find it.

The Golden Giant is reported as one of the producing mines of the camp.

*Forest City.*—This has for many years been, and is at present, the most important drift-mining district in the county. The leading mine in this district is the Bald Mountain Drift Mining Company. It has been in successful operation for many years past, and has disbursed several hundred thousand dollars to its shareholders. The old placers which have been worked so long seem to be nearly exhausted. The company has now encountered a new pay channel, distinct from the old one, which from present appearances probably courses through the entire length of the claim, and being still richer than the old Blue lode. It is some 50 feet lower than the old channel. This important find was the result of curiosity on the part of the superintendent to see what was below the lava flow that had, in times past, caused so much vexation in the minds of the managers. The channel lies to the east, between the Bald Mountain and the Bald Mountain Extension mines. The opinion of many is that the great Blue lode courses down the ridge from somewhere near the vicinity of Gold Lake, and there divides itself at different points wherever there are lateral ridges making out from the same. This may account for the frequent deposits or breakouts of gravel found in different places each side of the ridge, also in the cañons and rivers, all of which produce channel gold, the same as found in the Bald Mountain Extension mine, running up into nuggets of several ounces in weight.

The Ruby mine, working from the opposite side of Bald Mountain on the same channel as the Bald Mountain Company, bids fair to take the place of the latter as the leading gold producer of the district. Very encouraging developments have been made during the year. The main tunnel has been pushed ahead several hundred feet. A lower cross-channel has been prospected by tunnel and slope from the main tunnel, and a fine large body of pay gravel struck. This yields from $3 to $7 to the car-load. The yield of the mine has run as high as 80 ounces a week. The mine at present is one of the most promising in the county. From 20 to 70 men are employed.

The Bald Mountain Extension is coming to the front as a gold producer. After prospecting at a heavy expense for several years past, gravel has been struck that pays well. An air connection has been made with the Bald Mountain Company's workings.

The South Fork claim, adjoining the Bald Mountain Extension, has been leased and worked by the latter during the year. The channel runs parallel with and alongside of the Bald Mountain Extension line. From 30 to 50 men are employed breasting out the gravel. The main tunnel is in 4,000 feet. The gravel pays from $4 to $10 per car-load. The future prospects of the mine are excellent.

The tunnel of the Wisconsin drift mine, now 2,200 feet in, is entering softer rock, and indications are favorable for striking gravel. Fifty-six thousand dollars have already been expended on this claim.

All the drift mines noted around Forest City have a short supply of water for washing. Resource has been had to pumping in the Riocene shaft to increase the supply for the South Fork and Bald Mountain Extension claims.

*Alleghany.*—The old drift claims in this vicinity are being worked by a small force. The developments and interest of the year are confined to the quartz mines on the other side of the Kanacka Cañon.

The Gold King quartz mine has been opened to some extent during the year and promises well for the future. The ledge is from 4 to 5 feet wide and shows considerable free gold. The owners have 150 tons of ore on the dump that will pay for all the work thus far done. A new tunnel is being run to open the ledge 100 feet below the present works.

The Rising Sun ledge, a recent location, is being opened with very encouraging prospects. The ledge is well defined and varies in width from 20 inches to 5 feet. Two tunnels are in on the ledge and the ore taken out shows free gold. The facilities for economical and permanent working are excellent.

In the Harlem quartz mine a blind lead that is very rich in gold has been uncovered. Chlorination works will be erected on this claim soon. The ore yields 5 per cent. of sulphurets that pay $100 per ton.

The Buckeye Company during the year produced 635¼ ounces of gold, valued at $18.25 per ounce, fine.

There is some talk of opening the Golden Gate quartz mine, which has for several years been shut down.

Minnesota.—There is still considerable mining in this old camp. The Wisconsin Gravel Company employs 5 men, and is making quite satisfactory returns. Tunnels to open two other drift claims are being energetically pushed.

Quartz mining is again attracting much attention. A tunnel is being run to reopen the Ireland quartz mine and is now in 900 feet. This mine has been rich, and it is believed that equally rich ore will be found by the new tunnel.

The Hope quartz mine is not being worked at present.

The Plumbago quartz mine, one of the most promising in the section, is to be reopened by a new tunnel that will open the ledge to a depth of 160 feet, 100 feet lower than the old workings. There is an 8-stamp mill on the property, and the mine is expected to prove a big paying investment under the new management. Worked to a depth of only 60 feet $100,000 have been taken out, and the pay chute is known to be 800 feet long.

The owners of the Bullion are now engaged in driving ahead the main tunnel toward the vein.

Clipper Flat.—The leading mine here is the Rainbow, employing 70 men. The mine has yielded largely during the year, several extremely rich pockets having been struck. From one of these, $60,000 was taken out in one day, and over $100,000 in a month. A new tunnel is being run that will, when completed, be 2,300 feet long and will tap the ledge 400 feet below the present workings. The prospects for a continued yield are very flattering. The rich ore not saved for jewelry and specimens is pounded up in hand mortars, three or four men being constantly employed.

The Independence quartz mine, a short distance east of Clipper Flat, is being worked with excellent results. The main shaft is down 280 feet. The vein is a contact ledge between the slate and serpentine. The ore, which is highly sulphureted, has given an average yield of $20 per ton. Power for the hoisting works and mill is obtained from water brought from Wolf Creek.

On the main divide above the Bald Mountain Extension mine there has been considerable work done. The Seventy-Six Company has run a tunnel 600 feet long, striking gravel, but at too great a height to be profitably worked. The American Hill hydraulic mine was profitably worked during a short water season.

Downieville.—The Mount Vernon quartz mine at this place has been prospected for several years and sufficient development made to warrant the belief that it is a good paying mine. Two tunnels have been run in on the ledge opening up on a large body of ore.

The old Page quartz mine, located in Sailor's Ravine, and believed to be an extension of the Good Hope, makes an excellent showing. A tunnel run in on the ledge 20 feet shows a ledge 2½ feet wide, 4 inches of it enormously rich, and the balance good milling ore. The vein lies between slate and porphyry formations.

The Junction mine in Slug Cañon, worked in a small way by arrastras has paid very well, and is one of the most promising properties in that section. The ledge lies between walls nearly vertical, one slate, the other serpentine, and averages 3 feet in thickness. All the rock taken out and worked by arrastras averaged $15 per ton.

The Atwood drift mine, near Rocker Flat, is doing very well, though at present not worked extensively. Several quartz strikes are reported in this vicinity, but as yet are of undetermined value.

The Primrose mine, in Hog Cañon, has been reopened and the mill started up. A large body of fine milling ore has been opened up, and the mine is rivaling its large yield of several years ago. Several other ledges in this locality are being opened up, and are promising properties.

In the Morristown Company's claim gravel has been struck that prospects $2 per load.

Logansville.—This place has been growing rapidly during the year, owing to the quartz-mining industry of its vicinity. The bar claims on the Yuba, near this place—the Logansville, Avanges, and Dutch—all paid well during the year, and have excellent prospects for several years to come. The bed of the Yuba River is mined for several miles below this place by Chinese, and in the aggregate a large amount of gold taken out.

The Marguerite still continues the leading quartz mine at this place. Extensive improvements have been made, the most important being the substitution of water-power for steam in the hoisting works. This was done by taking the water after it had furnished power to run the mill and conducting it through a turbine, from which the power is transmitted by wire pulleys 1,200 feet. The monthly returns from the mill have run from $15,000 to $25,000, a decided improvement over 1882.

Another mine in this locality, the Roman, situated about one mile east of the formerly celebrated Keystone, looks well and will probably make an excellent showing during the coming year.

*Sierra City* is the leading mining district in the county. Several large mining enterprises have been initiated and taken practical shape during the year.

The Sierra Buttes quartz mine is still the leading producer. During the year, ore has been hoisted to tunnel No. 7, where the mill is located, by water-power. Tunnel No. 9 reached the ledge when in 2,500 feet, most of it in extremely hard rock. It will have to run about three-quarters of a mile more to open up the principal ore-chute. A 60-stamp mill is in process of erection at the entrance to No. 9 tunnel. From June 30, 1883, to December 31, 1883, the mine yielded 15,769 tons of ore, which averaged $7.48 per ton, and including the sulphurets, $8.18 per ton. The working expenses average $5.56 per ton, of which the milling costs 58 cents per ton. Excluding the cost of No. 8 and No. 9 tunnel the working expenses are $4.15 per ton. The construction of the eighth tunnel took 51 cents, and of the ninth 90 cents per ton of the ore worked. The average yield per ton is $1.02 greater than in 1882, with the cost of mining and milling the same.

The Florence quartz mine is on the ridge above and south of Sierra City. A tunnel has been run tapping the ledge at a depth of 200 feet on the pay chute. The vein at this point is 4 feet wide and has, worked in arrastras, paid as high as $70 per ton.

The Columbo quartz mine is located west of the old Independence claim, and is certainly a continuation of the end of the Sierra Buttes lode. During the year a large amount has been expended in developing and fitting up the mine for permanent operations. One tunnel cuts the ledge at a depth of 225 feet, exposing a large body of pay ore. The vein is 3½ feet thick and has a general east and west course. Stopes have been opened and air connection made with the surface, and a lower tunnel, cutting the ledge at a depth of 450 feet. From the latter a double tramway has been constructed to a new 20-stamp steam mill lower down on the side of the mountain. An assay office, boarding-house, and other necessary mine buildings have been erected. At present 80 men are employed.

The Phœnix quartz mine is supposed to be an east extension of the Sierra Buttes. The work of prospecting and opening has been very thoroughly done, and it is estimated that there is already $200,000 worth of ore in sight. A mill will shortly be built and 40 or 50 men have steady employment.

A quartz ledge has been located near Deer Lake, north of the Sierra Buttes, that is considered very important. So late in the year was the discovery made that little work could be done. Prospect holes 400 feet apart expose rich ore. The vein varies from 3 to 7 feet in width.

In the Thousand and One drift mine the channel has been found, and gravel is being taken out that pays well.

The Four Hills quartz mine, near the county line, 15 miles northeast of Downieville, has proven a perfect bonanza during the year. It is claimed that coarse gold picked out of the rock while the mill was being constructed paid every expense of working and construction, and left a fine balance in addition. During the months of May and June the product of the mine was claimed to be $100,000.

*Gold Lake.*—The water season in this district was very short, still all the claims yielded returns. In the Foss claim $3,000 in specimens were picked up on the bed rock in two days. One of these was a nugget worth $1,500.

The results of the year's mining in the county are in the highest degree encouraging. Hydraulic mining was hampered by a short and intermittent water season, yet made fully average returns for the time worked. Drift mining was quite prosperous. Quartz mining has experienced quite a revival. The district around Alleghany has received considerable attention at Sierra City, and a large extension of the industry has been made.

## SISKIYOU COUNTY.

Siskiyou is one of the extreme northern counties in the State, being bounded on the north by Oregon, east by Modoc County, south by Shasta and Trinity, and west by Del Norte. The county is large and generally rough and mountainous, with very large rivers and precipitous cañons. The mining industry is well distributed over the county, the mines on the Klamath River being mostly placer, while quartz mining is confined mostly to the vicinities of Indian Creek.

*Callahans and Salmon River districts.*—Mining has been energetically carried on during the past season with very satisfactory results. Additional capital is being invested, new enterprises inaugurated, and a large amount of prospecting going on. Like many other counties in this State, Sisikyou has suffered from a lack of water during 1883, and a consequent reduced bullion yield.

Fort Jones, which is located on Scott River, a branch of the Klamath, is the center of quartz mining in this portion of the county.

On Grizzly Gulch the mine of Baily, Brown & Co., is in operation and doing satisfactory work. The ore is taken from the ledge through a tunnel 500 feet in length, and when worked by the 5-stamp mill, owned by the company, yields about $22 per ton. The mine has been worked about four years, and its present prospects are good.

Wood & Anderson also own a good mine at this place with a 5-stamp water-power mill, but it was idle during a portion of the year. It has lately started up on 600 tons of ore, and expects to make good showing on the "clean up."

Steward & Short have a tunnel 320 feet in length and are taking out some good ore.

The Mathewson mine is also operated through a tunnel and the ore worked by an arrastra. Average value of the ore, $107 per ton.

The Tompkins mine is also worked by arrastra and yields fairly well.

The Oak Grove drift mine at this place, which has been continuously worked for the past twenty-two years, is in operation and producing well. The company have gravel sufficient to last twenty years.

Mr. A. B. Sell has a drift mine at this place which has only fairly opened, but bids fair to be a good mine.

The mining at Forks of Salmon is chiefly hydraulic. There are no very extensive mining operations carried on here, but quite a number of mines operated in a small way that pay the individual owners well. Among the latter may be mentioned the Shanway Brothers, Hamill & Bloomer, Bennett & Miller, and Michael Walker, all of which have been in operation during the past season.

Callahan's.—This is also a locality where most of the mining is placer, either drift or hydraulic.

The Fortune mine at this place is a good producing mine, which has been worked six years and has sufficient gravel to last five or six years longer.

The Meyer & Kuchenback drift mine was successfully worked during the past season. Only 3 men are employed in and around the mine, and it pays about $6,000 annually. It is good property and has been worked steadily for the past eight years.

The Montezuma placer mine is a good paying property, but, owing to the short water season in 1883, did not do as well as ordinary years.

The Foch claim had a fair run and product, considering the short supply of water.

The McConnell placer claim at Yreka is one of the largest producers in the county. The gravel is washed out from an open cut, and is worked cheaply. The company own about 40 acres of gravel, upon which they have been at work about three years.

Sawyer's Bar is located upon the Salmon River, a tributary of the Klamath. The mining at this point is mostly placer, drift and hydraulic. The placer diggings were first struck on the river in 1851.

G. A. Moore & Co. are operating their placer claim, and it is paying well.

About 20 miles above where it empties into the Klamath, the Salmon forks and forms two streams, known as the North and South Forks. On both of these some very rich placer diggings have been found and worked to a more or less extent from 1851 up to the present time. There are numerous little gulches putting into these forks, and some rich quartz ledges have been found at the head of the gulches.

The Black Bear quartz mine is situated at the head of the Black Bear Gulch.

The placer mines on the river are of two kinds—river and hydraulic.

The Bonanza mine, owned by Myers & Kuckenback, has yielded in the last seven years about $60,000. It is a large bar claim, and is situated on the bank of the river 50 feet above the bed of the stream. The gravel is about 40 feet thick, and all contains more or less gold. It is worked by drifting, only about 6 feet of the bottom gravel, which is on the bed rock, being worked. Three men do all the work.

The claim owned by G. A. Mohr & Co. is worked with a derrick, and is from 20 to 30 feet below the bed of the river, and has been worked for more than twenty years. From $100 to $300 per day have been taken out of this claim when on the bed-rock. There is ground enough to last for many years. The work is all done by four men.

There are a number of other claims in this locality, such as the Gold Hill, Red Hill, T. Hickey's, all of which are hydraulic claims, and can only be worked from three to four months in a year, in the winter time, the supply of water being obtained from small gulches.

One of the tributaries of the North Fork of the Salmon River is Eddy's Gulch. At the head of the gulch is the Uncle Sam and Klamath quartz ledges. The first is a new mine, discovered within the last three years, and has yielded some very rich quartz. It has an 8-stamp mill, run by water-power from three to four months per year, paying on an average about $20 per ton. The Klamath mine was discovered more than twenty years ago, and appears to be a pocket ledge, some $80,000 having been taken from a pocket some six years ago, and some of the richest specimen quartz ever taken from the State was extracted from this mine. The company own a 32-stamp mill in connection with the mine. Of late years it has not paid expenses, but prospecting is still being done.

Mining in this portion of Siskiyou County is undoubtedly in its infancy, as the mines are located in the mountains, some 25 miles from a wagon-road, and all supplies have to be packed on mules and transported over a mountain trail.

Hamburg Bar.—At this place Steel & Co. and Singleton & Co. are working their respective placer claims with satisfactory results.

John S. Louden also has a hydraulic mine here which has been worked the past seven years and is doing well. Mahleson and Caldwell are still working their drift mine at this place, which has been constantly worked for eleven years. It is a portion of one channel of the Klamath River that runs through a bar, and is about 400 feet from the present bed of the river. It has paid well, and with good prospects for the future.

The Centennial mine at Honolulu is still in operation.

Oro Fino.—The Carroll Brothers have a quartz mine in Quartz Valley which is being worked by arrastras. The Allen Brothers have a good quartz mine which is worked through a tunnel 450 feet in length, and is yielding well. There are also several hydraulic mines being operated here.

The John Young mine has been worked for eighteen years and bids fair to last eighteen years longer. It is a good paying mine, and has recently been sold to Eastlich & Bro.

Wright and Fletcher are also operating their hydraulic mine which has been worked twenty-five years. The yield for the past season was light, owing to a scarcity of water.

There are a large number of Chinese operating in the shallow places near Fort Jones and Callahan's, and it is safe to say that $60,000 has been taken out by them at these points.

The Black Bear quartz mine, situated at Black Bear, is producing about as usual. It is a fine property.

There are quite a number of good paying mines on the Klamath River, which are operated upon rather a novel mode of mining. They are river-bar claims. The mineral is mostly found on the bed-rock in the bed of the river, whose waters are turned by head and wing dams. The depth to bed-rock varies from 20 to 60 feet. The gravel is removed with derricks run by water-power and the gravel is washed with water supplied by dip-wheels placed in the river current, which is conducted into sluices. During the winter season river mining is suspended, there being only about seven or eight months of mining season during the year. Some of the mines operated as above described which have produced fairly well during the past season are the Knapper Bar, Phill Mott Company, Empire Bar, Centennial, Kanaka, Swiss Bar, Lime Gulch, Bebe Bar, and several others. There are no creeks or shallow placer mines in the vicinity, although gold is found in nearly all the gulches and ravines, but not in paying quantities.

## TRINITY COUNTY.

Of the large scope of territory embraced within the boundaries of Trinity County that portion only which is drained by the waters of Trinity River and its branches is classed as mining, the southern portion being utilized almost entirely for grazing and stock-raising purposes. Coming north from Mendocino County line, the first indications of a gold region are found in some gulches connecting with the South Fork of Trinity River, but a great deal of prospecting has failed to develop anything that will pay for working.

On Hay Fork of the South Fork of Trinity River, 24 miles south from Weaverville, a large amount of work was done in former years, and good results obtained, but at present are only worked by Chinese. The gold of this locality is of low grade, being worth only about $16 per ounce. There is a large scope of country that would pay small wages if water could be obtained.

*Indian Creek district.*—But few claims were worked in 1883, being Martin Keefe in Spring Gulch, and two or three others of but little note. This fact is in a great measure due to the character of the winter of 1882–'83, which was the poorest water season for Trinity County since the winter of 1851. This is the cause of the decrease of the bullion output of Trinity County. Many claims having good water rights worked less than one-half the usual number of days, while those depending upon small streams for their water did but a few days' work during the entire season. As the gold deposits are worked farther back into the hills and benches, thus becoming more deeply covered with barren earth, it requires a greater amount of water to insure successful workings. Then, again, the introduction in late years of large pipe and giants in hydraulic mining causes the owners, where a plentiful supply of water is available, to rush off much heavier gravel than was formerly done. The demand for a greater water supply has not been met by the construction of new ditches or by the enlargement of those already in existence. As a rule the placer mines of this county are formed where the bed-rock is of slate, except towards the heads of streams in high mountains. There are two other exceptions, viz, at Weaverville and in Readings Creek district, in each of which places the bed-rock is partly sandstone and partly cement.

Several attempts have been made in Weaver Basin to find the true bed-rock, but in only one instance was the attempt successful. In 1854, Mr. Sites, aided by private subscriptions from merchants and miners of Weaverville, sunk a shaft through the cement, and found bed-rock at a depth of 600 feet. The "color" was found in several places in going down, and that was about all that was found on bed-rock.

No attempt whatever has been made to pass through the cement in Readings Creek district. In the last-named locality several petrifactions are found in the bed-rock when it changes from cement to sandstone.

Until within the past four or five years the gold product of Trinity County was almost wholly produced from placer mines. Such attempts at quartz mining as had been made proved abortive, and were very discouraging to those engaged in this method of mining. However, recent developments in *Deadwood*, *Bully Choop*, and *East Fork districts* have been productive of such results that it is now a foregone conclusion that quartz mining will gradually come to the front as the leading mining industry of the county. One quartz mine in Deadwood district has returned over $60,000 net to its owners for the past three years. The good results obtained by this mine have had the effect to stimulate prospecting in various other places, and quartz ledges of good promise have been discovered on New River, while others of lesser note have been found in *Minersville* and *Trinity Center districts.*

Gold mining has been continuously pursued in Trinity County since its first discovery in the State, and is the only metal sought for at present in this county.

Rich deposits of cinnabar were discovered on the headwaters of the main Trinity River, and were advantageously worked from 1872 for several years, but, owing to the low price of quicksilver, work has entirely stopped. From indications which have been observed in the western portion of the county, south of the main Trinity River, it is highly probable that leads of cinnabar will be found in that section at some future day.

Small quantities of platina are found on Brown's Creek, and near the head of that stream is a mountain rich in magnetic iron. The particles of platina are very fine, and, being heavier than gold scales with which they are found mingled, are a source of annoyance to the miners.

A lode carrying metal supposed to be iridium was recently discovered about 6 miles above Weaverville, on East Weaver Creek, but at the present writing no returns have been received of the assay.

Adjoining Indian Creek district is *Readings Creek* mining district.

The only claims in this district that produced in 1883 are the O'Connel, Paw Wicket, and A. W. Smith.

The Casy mine, on Indian Creek, owned by J. A. Johnson, is an extensive and valuable mine, but was not worked in 1883.

In Douglas City Township and district the following mines were worked during the past season: Pike County Bar, J. Daly; Steiner's Flat, Horst and Elmson; Buckeye Bear, J. A. Hubbard; Fillibuster Flat, Smith's Flat, Chinese; Ferry Bar, Chinese; Ingram's Bar, Chinese; Mabrie's Ranch, Chinese; Red Point, Burth & Eddy; and Mouth of Indian Creek, by a Portuguese company.

The claim of Bowie & Co. produced a fair amount of bullion by reworking a gulch which had for many years been used as a deposit for tailings from Union Hill, but that is now exhausted.

The *Junction City* and *Oregon Gulch mining districts*, with the *Red Hill district* adjoining, are the most extensive and valuable in the county for placer mining. Located here are the Chapman & Triche, Sturdivant, Ward, Slattery, Reno, Pickett, Mammoth, Evans & Bartlett, Henry Jacobs, Sheridan, Good Friday, Joe Ham, the Hemes & Hedges, each one of which is considered good mining property. There are also a number of small claims worked a little by their owners.

In the matter of improvements for 1883 but little was done, except the ditch and pipe intended to take the water of Cañon Creek across Trinity River for the purpose of working the interest of Dr. Hays in some ground purchased by him last year. Mr. Ham has also completed a ditch from Maxwell's Creek to the Ham mine, which gives 130 feet of pressure, and is high enough to be carried across Trinity River and put upon the upper benches opposite.

The district within a scope of 5 miles of Junction City embraces a large amount of placer-mining ground, in fact so large that with the present water supply it could not be worked out in fifty years.

The owners of the famous mines at Red Hill are at present engaged in litigation over their water rights, and work at the mines is practically suspended.

In the *North Fork* and *East Fork districts* placer mining has fallen off greatly, but in the last-named district some quartz discoveries have been made within the past year which give promise of good results. Ten tons of assorted ore of these veins yielded $100 per ton.

*Cox's Bar* and *Taylor Flat districts* show several good paying mines. The claims of Price, Patterson, Vance Brothers, and Johnston all gave good returns.

The Wilshire mine was not worked in 1883, but has been leased to James Wallace, who will work it in 1884.

The Taylor Flat mine has been sold to Jillson & Co., who will soon put it in shape for work during the coming season.

*Lower Trinity* and *New River districts* are remote from communication with the remainder of the county, the residents only coming in when they have business at the county-seat, while their supplies, machinery, &c., are brought in from Humboldt County. The country is very rugged and mountainous, and communication is only had by mule trail.

Some very good quartz mines are said to have been discovered during the past year, and this class of mining will probably receive more attention during the coming season.

In the northern portion of the county the Cuffee Creek mines have been more extensively worked during the past year than for several years past.

*Trinity Center district* shows a number of the old claims still being worked at a profit, and some new ones developed on the east fork of the stream, notably Blass & McClary, A. P. Hawkins, Coyle & Freethy, and the old Coyle claim, now leased to Chinese. The latter is now in good repute.

At Minersville the mining population is scattered over quite a wide expanse of territory, of which Minersville is the center. Located here are the following claims: Reordon, at the old Folly diggings, on Stewart's Fork; Skewis & Sons, on Mule Creek; C. M. Mead, on Mosquito Gulch, and Reed & Van Meter, on Buckeye Gulch, all of which are said to be doing well.

The principal claims in the *Cañon Creek district* are the Flowers, Murphy & Son, Murphy & Mattison, and C. Dannenbrink. The Cañon Creek mines are what are known as heavy claims, the deposits lying in the high benches or low hills adjoining the stream and requiring large quantities of water to work them successfully.

*Lewiston district.*—The Carter Bar claim, owned by Loudon & Bates, is properly in Grass Valley, but is noted here for convenience. It is an extensive low-bar deposit, and the rivers at this point, not being filled up so much as is the case below, can be successfully worked. The same may be also said of the Cronin mine.

In this district is located the famous Bolt's Hill mine, owned by the Buckeye Ditch and Hydraulic Mining Company. English Tom, Eastman, John Smith, and Chamberlain mines are also located here, and have been worked for some years past.

The quartz mines of this district which have been recently discovered and opened are attracting much attention. They are located principally on Jennings's and Eastman's Creeks. The quartz region lies partly in Trinity County and partly in Shasta.

The most notable mines here in which pay quartz has been found are the Vermont, Barton, Bismarck, Brown Bear, Black Bear, Hickeys, Henry Clay, M. Klein, Phillips, Montezuma, Isola, Minnesota, Backbone, and Knowles. There are also other locations of more recent date which give promise of being valuable properties.

The Vitura mine in this district was discovered during 1883, and has paid.

Prospecting for quartz ledges is very lively in this district, and new finds are reported from time to time.

The *Bully Choop district* is at the head of Indian Creek, and is likewise partially in Shasta County. The main ledges in this district on the Trinity side of the line are the Bully Choop and Occidental, owned by an association. The company has run a tunnel about 600 feet in length, and is now sinking a shaft to determine the course of the ore-chute. About $10,000 have been expended in prospecting and developing the mine, and they feel assured of good returns in the near future. There are several other good, promising locations in this district which are but slightly developed.

*Weaver Basin district.*—This district, embracing what is known as Weaver Basin, is a comparatively level scope of country, circular in form, and from 3 to 4 miles across. But very little bed-rock has ever been found in this place, the gold deposits being found either in the shallow surface earth or in a cement or sandstone bed-rock. Attempts have been made at various places to sink through this false bed-rock, but was only successful in one instance. At a depth of 600 feet the true bed-rock was found, but no gold in paying quantities was found. The outlet for the waters of the basin at the present time is Trinity River, through the bed of Weaver Creek. The basin proper is at an altitude of several hundred feet above Trinity River, the town of Weaverville being 369 feet higher than the river, having an average fall of 11 feet to the mile along that part of its course. It is, however, probable that in former ages, when (if we can believe Indian tradition) the basin was a large lake, the point of *débouchuré* was through Oregon Gulch, 10 miles below the present point, and under the immense gravel-beds now being worked by the Trinity River Mining Company.

The principal claims now being worked in the basin are those of Rule Brothers, Happ & McMurray, Harvey Brothers, Loudon Brothers, Garden Gulch, Hocking, and Sidney Hill. The last two are owned and operated wholly by Chinese.

Mr. John McMurray estimates the yield of the mines in the immediate vicinity of Weaverville at about $80,000.

| | Gold value. |
|---|---|
| Harvey Brothers | $13,600 |
| Rule Brothers | 5,827 |
| McMurray & Happ | 8,821 |
| Isaac Woodbury, about | 2,500 |
| Trinity Gold Mining Company | 5,900 |
| Hong & Co., Chinamen | 17,000 |
| Win Chung & Co., Chinamen | 8,000 |
| Esing & Co., Chinamen | 6,000 |
| All other Chinamen, about | 12,000 |

In the last item is included the production of gold by about 50 Chinamen, operating in a small way, and I think is as nearly correct as can be obtained.

Owing to a scarcity of water the production in the last year was small.

The recent decision of Judge Sawyer has caused uneasiness among mine owners, but not to the extent which is felt in those mining counties bordering on the Sacramento Valley. It is agreed that inasmuch as the Trinity and Klamath Rivers, down which the *débris* of the Trinity mines passes, are not navigable streams, and running most of the way through narrow cañons, the *débris* cannot destroy any great amount of valuable agricultural land. Both of the above-named streams, being very rapid, carry most of the *débris* direct to the ocean, except it may be the finer and lighter particles, which experience has shown to be of a fertilizing character, and is carried over lowlands only at the period of high water. In the mining section it is the practice to flood a piece of worked-out land, and the soil thus made raises fine crops of fruit, alfalfa and other grasses, where irrigation can be had. It is hoped and believed that in a few years these considerations will direct the attention of capital to the placer mines of this and other counties similarly situated, and lead to continual working of these valuable deposits. The water season of 1883 was so short that some good claims took out no bullion whatever, while the yield from all the placer mines was much less than in ordinary seasons.

An approximate estimate of bullion shipped from this county for 1883 would be—

| | |
|---|---|
| From Weaverville | $435,410 |
| In private hands, via Redding | 240,000 |
| Lower Trinity, New River, and Cox's Bar | 30,000 |
| Total | 705,410 |

Owing to lack of water the season was a bad one for Chinese as well as whites, but a fair estimate of that portion of the above production produced by Chinese would be about $135,000.

## TUOLUMNE COUNTY.

This county lies in the southern portion of the State and has an area of about 915,000 acres. The soil in the western portion of the county, which extends from the foot-hills to an elevation of 2,500 feet in the Sierras, is particularly well adapted to fruit and vines. The county extends from the Stanislaus River on the north to the divide between Tuolumne and Merced on the south, and from the summit of the Sierras to the low foot-hills. In former times "Old Tuolumne," so called, occupied quite a prominent place in the list of mining counties of the State. The shallow placers, like those in most of the other counties, are all exhausted, and are worked very little except by Chinese. There are several hydraulic and gravel ridges above Big Oak Flat and Cherokee Table Mountain, which, following the Stanislaus River from Columbia to Knight's Ferry, cover a rich auriferous channel, which is being worked through tunnels.

Quartz mining has received a fresh impetus within the last two years in this county. Quite a good many investments have been made by capitalists, and more prospecting made for quartz than any other class of mines.

Among the quartz mines situated on what is called the "mother lode," which runs through the entire length of the county, is the Patterson mine. The ore from this mine is free gold, and is in slate formation. The mine has been in operation for a long time, and the results of its 20-stamp mill are very satisfactory. The shaft is down to a depth of 620 feet, and is an incline which gives it a depth of over 500 feet perpendicular. A new pump has lately been put in, which will handle all the water to a depth of 1,000 feet, to which it is intended to sink the shaft. When new levels are run and the mine thoroughly opened it is proposed to add 20 stamps more to the mill. This mother lode is of great width, in many places averaging 60 feet, and the rock yielding, when worked in bulk, from $3 to $6 per ton, and anywhere in this section the rock can be mined and milled at an expense of $1 a ton or less.

W. N. Harris has furnished a practical illustration of what can be done in mining in the slates to the east of the mother vein. A little more than three years ago he bought the Alabama mine and erected a 40-stamp mill on it. With this mill he is able to crush 80 tons of ore every twenty-four hours. The total expense involved in extracting and crushing does not exceed $1 per ton, while the actual results have been a yield of from $2.50 to $2.75 per ton.

At Quartz Mountain the Heslep mine is the only one at work to any extent. This mine has a force of from 15 to 20 men employed. The shaft has been repaired during the past summer, and extended to a depth of 40 feet. The company have also commenced a new shaft at the eastern end of the mine, through which all work will be carried on when completed. The mill, which is water-power, has twenty stamps, and the property has been worked continuously for twenty years with varied results.

The Knox and Boyd mine is idle, but the mill is kept running on custom rock.

J. G. Divoli is opening up a large gravel property 2 miles in length, situated between Jacksonville and Stevens Bar. The gravel is near the combination of claims known as the Yosemite and Grand Rapids quartz claims on the mother lode, both valuable properties. The gravel which has been discovered is a river channel, formerly the course of the Tuolumne River. The water, the source being the Tuolumne River, will be brought in a ditch, and utilized for mining machinery for the proposed quartz mills, which will have from 50 to 100 stamps.

At Blue Gulch the Shawmut Mining Company have completed their tunnel, which runs from a point near and above the left bank of Wood's Creek, a distance of about 1,000 feet. All future operations of the mine will be carried on through this tunnel. The future prospects of this mine are said to be good.

Near Jacksonville, on the Tuolumne River, the Long and White mine is being prospected to some considerable extent, and a ledge of ore struck, which is said to be of low grade, but owing to the extensive deposit its owners consider it a valuable mine. The company will soon commence the erection of a large mill to reduce the ores.

In the *Sonora district* are quite a number of mines being worked in a small way. These mines are mostly what are known as "pocket mines," and worked by individuals, and but little information can be obtained from them as to the results of their operations.

The Lamphear mine, located immediately to the north of the old Confidence mine, which in former times produced so much gold, and was looked upon as the leading quartz mine of the county, has made a fine development. The characteristics of the ore are much the same as that of the Confidence, the vein having the same blue streak of sulphurets, known as the "Confidence streak," running through it. The ledge, as in the Confidence, dips very flat, lying at an angle of about 33 degrees, though it varies at different points. An incline shaft has been sunk to a depth of 165 feet on the ledge, which everywhere shows strength and regularity. In the bottom the ledge is 3 feet thick, all solid milling quartz. From the bottom of the shaft a drift is being run north on the vein. The drift is in about 30 feet, with about 20 inches of very rich quartz on the face, much of it showing heavy sulphurets. To the south of the shaft the drift is in on the vein 50 feet. Here the ledge is wider, but the pay is split in two seams. Both are of good size, and the quartz is rich, being streaked with heavy blue sulphurets, and sometimes showing coarse free gold. On the dump is a large quantity of quartz, which working tests prove will work $45 per ton as it comes from the mine; a mill is soon to be erected.

At a point above the left bank of the Stanislaus River, about 2 miles below the North and Middle Forks, several new discoveries have been made during the past year. The prospects of these mines are said to be very flattering.

In the *Columbia*, *Yankee Hill*, and *Saw-mill Flat districts* are quite a number of localities being worked in a small way, but being mostly pocket mines it requires but few hands to work them. In fact, they are nearly all worked by individual owners. Among these are the Arnold, Riffle, Staten & Co., Stark mine, and Knapp, Birney & Co., in the Columbia district, and the McPherson & Hilton quartz mine in the Saw-mill Flat district, the latter of which has yielded very handsomely during the past season.

At Soulsbyville the old Soulsby mine is still at work. The hoisting works at the south shaft were destroyed by fire last summer, and new ones immediately erected, and are now in working order. The mine is said to be looking well in the lower levels, and its future prospects are favorable.

In *Cherkoee district* the Rising Sun mine is the only one in active operation. This mine is said to be paying well. The company have a 10-stamp mill, and all indications tend to insure a valuable property.

East of the North Fork of the Tuolumne River the Buchanan mine is the only one in active operation. This mine at present shows every indication of being a valuable and permanent mine. The company have steam hoisting works, and it is intended to sink the shaft to a depth of 500 feet without interruption. A fine chute of ore has been opened up, and the future prospects of the mine are very bright. A 10-stamp steam-power mill has been erected near the mine.

On the south side of the Tuolumne River but little has been done in quartz mining during the past season. Some prospecting has been done on the Mohrman quartz mine, but at present all work is suspended.

At Brunson the Stewart and Crocker placer mines are being worked when water can be obtained in sufficient quantities, and with good results.

The placer-mining interest, as a whole, is still on the decline, although, owing to the extreme dry season and the low stage of water in the Tuolumne and Stanislaus Rivers, the Chinese have had quite a successful season, and the yield from this source will equal that of 1882.

Mr. Charles L. Lang estimates the production from the various mines as follows:

| | Gold value. |
|---|---|
| Soulsby (estimated) | $150,000 |
| Patterson | 48,000 |
| Riverside | 30,000 |
| Green | 45,000 |
| Golden Era | 50,000 |
| Easton | 6,000 |
| Stanley and White | 7,000 |
| Mooney | 10,000 |
| Heslep | 20,000 |
| Davis | 10.000 |
| Alabama | 5,000 |
| Various "pocket mines" (estimated) | 75,000 |
| Orcutt | 2,500 |
| Santa Maria | 1,750 |
| Total value | 460,225 |

## YUBA COUNTY.

The mining industry of Yuba County has been gradually diminishing in importance for several years. The placers have always been the source of the gold yield, quartz mining never having produced much, and they, except in one or two small areas, were shallow and worked out years since.

The mining section of the county lies in the lower foot-hills of the Sierras, the highest elevation being in the extreme northeastern part, near the western boundary of Sierra County and the southwestern corner of Plumas County. The entire drainage of this section is into the North Fork of the Yuba River and its numerous tributaries. The general surface, though broken and hilly, is not as deeply cut into by the cañons of the streams as in the adjoining mining counties of Butte, Sierra, and Nevada. The prevailing country rock is slate, though granite formations appear through a considerable area in the central portion of the mining district.

The lava-covered area is comparatively much less than in the adjoining counties. This and the absence of extensive channel deposits of auriferous gravels will account for there being no drift mines. There is, however, one important and extensive deep-placer district at Smartsville, but the gravels at this point cannot be profitably worked by drifting, and have only paid well when hydraulicked.

The Excelsior, Bonanza, and Blue Point hydraulic mines were three years since considered among the most valuable and important in the State. They employed over 500 men and had an annual gold product of $750,000. During 1883 no work was done, the courts having enjoined them from operating early in 1882. There seems no possible chance for a resumption of work, and they will have to be abandoned. Smartsville is already nearly depopulated, and in the course of two or three years will be entirely so.

*Brownsville.*—Next in importance to the hydraulic mines of Smartsville are those of Brownsville, situated near the northern boundary of the county. The deposits worked are the flat-bottoms of small mountain valleys. and range in depth from 10 to 20 feet, the gold being on the bed-rock.

The more important claims are the Nevada, Portuguese, Motor, Steele & Co., Kendall & Roberts, and Connor. Of these only the two first named were operated in 1883.

The Nevada Company used 1,000 inches of water, washing a bank averaging 15 feet in depth. The mine was worked 300 days and employed 20 men. The yield was much larger than for the previous year.

The Portuguese claim made a successful season's run, though not worked so continuously and extensively as the Nevada.

None of the mines in this district can be successfully worked by any other than the hydraulic method, and if enjoined will be permanently shut down.

The Mount Hope or Beehive quartz mine was not worked during 1883.

*Camptonville.*—There is very little mining being done in this vicinity. The Weed's Point hydraulic mine was worked and paid moderately, and employed 6 men. Unless shut down by injunction, the mine will be worked in 1884.

Mr. J. P. Brown, of Camptonville, estimates the production of the mines of *Slate Range district* at $116,000, as follows, viz:

| | |
|---|---|
| Alaska Mining Company | $17,000 |
| Arnott & Co | 30,000 |
| Bliss & Co | 10,000 |
| Joubert & Co | 6,000 |
| Marks & Co | 30,000 |
| J. S. Stephens | 4,000 |
| Weed's Point Company | 5,000 |
| Winselman & Co | 4,000 |
| Twenty small companies | 10,000 |
| Total | 116,000 |

The Brown and Purrington claim was not worked in 1883. The Chinese production for the year in this district was $12,000.

*Indiana Ranch.*—No returns have been made from this district.

The quartz mines from Brown's Valley to Hansonville have been worked during the year.

The Chinese production of the country coming from the vicinity of Camptonville, the bars and bed of the North Fork of the Yuba and Slate Creek, and old tailings, aggregates $30,000.

The future outlook of the mines of this county is very unpromising. The largest of the hydraulic mines are already closed down, in all probability permanently, and the others still working are likely to be very soon. The annual gold product will then only come from the Chinese and quartz. Quartz mining in this county is not, however, capable, from present and past indications, of much extension. The ledges are small, the ore low grade, and somewhat rebellious. One source not yet mentioned may continue to yield a large amount of gold for years, the necessary plant and equipment once being well put up. This is the immense mass of tailings by which the river cañons are filled to a depth, in some places, of a hundred feet or more. These all contain gold, and the annual supply from the hydraulic mines being cut off, they can be gradually worked by flumes and sluices. The necessary expense, before any return can be looked for being enormous, it is hardly probable that any attempt will be made to work these tailing claims at present.

*California mining assessments*, 1883.

| Mine or mill. | County. | Number of assessments. | Amount. |
|---|---|---|---|
| Alaska | Sierra | 2 | $14,000 |
| Alexander | Calaveras | 1 | 50,000 |
| Alhambra | El Dorado | 1 | 7,000 |
| Baker Divide | Placer | 1 | 2,000 |
| Bald Mountain | Sierra | 1 | 3,000 |
| Bechtel Consolidated | Mono | 1 | 10,000 |
| Bodie Consolidated | do | 2 | 100,000 |
| Bodie Tunnel | do | 2 | 40,000 |
| Boston Consolidated | do | 1 | 25,000 |
| Calaveras | Calaveras | 1 | 500 |
| Champion | do | 3 | 9,000 |
| Consolidated Amador | Amador | 3 | 45,000 |
| Consolidated Pacific | Mono | 1 | 9,000 |
| Double Standard | Tulare | 1 | 5,000 |
| Excelsior Deep Gravel | Placer | 2 | 32,500 |
| Excelsior Water and Mining | Yuba | 2 | 210,000 |
| Genesee Valley | Plumas | 1 | 4,000 |
| Golden Fleece | Placer | 3 | 11,500 |
| Goodshaw | Mono | 1 | 10,000 |
| Gorilla Mill | do | 2 | 15,000 |
| Harrington | Calaveras | 1 | 5,000 |
| Hazard | Placer | 1 | 15,000 |

*California mining assessments*, 1883—Continued.

| Mine or mill. | County. | Number of assessments. | Amount. |
|---|---|---|---|
| Homer | Mono | 1 | $10,000 |
| Homeward Bound | Placer | 1 | 25,000 |
| Hope | Sierra | 1 | 250 |
| Lucky Hill Consolidated | ....do | 1 | 10,000 |
| Mariposa | Mariposa | 1 | 25,000 |
| Maryland | Mono | 1 | 750 |
| Mayflower | Placer | 3 | 29,000 |
| Mount Auburn | Nevada | 3 | 30,000 |
| Noonday | Mono | 1 | 100,000 |
| North Noonday | ....do | 1 | 100,000 |
| Oro Mill | ....do | 1 | 10,000 |
| Pacific Mill | ....do | 1 | 2,500 |
| Pleasant Valley | El Dorado | 2 | 30,000 |
| Pittsburg | Nevada | 2 | 30,000 |
| Red Cloud Consolidated | Mono | 1 | 100,000 |
| Rocky Point | Placer | 1 | 15,000 |
| Ruby Gold | Sierra | 1 | 2,500 |
| San Pedro | Calaveras | 1 | 5,000 |
| Scorpion | ... do | 2 | 20,000 |
| South Hite | Mariposa | 1 | 3,000 |
| Summit | Mono | 1 | 1,000 |
| Trinity | Trinity | 1 | 3,000 |
| Winthrop | Shasta | 1 | 25,000 |
| Total |  | 64 | 1,199,500 |

*Table showing operations of some of the leadiag gold-quartz mines in California during the year* 1883.

| Name of mine. | Location of mine. | Average number of miners employed. | Miners' wages per day. | Cost of— | | | | Depth of mine in feet. | Number of tons extracted and worked. | Average yield per ton. | Per cent. of sulphurets. | Total bullion production. | Remarks. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Sinking, per foot. | Drifting, per foot. | Mining, per ton, including dead work. | Milling, per ton. | | | | | | |
| Patterson | Tuttletown, Tuolumne County. | Shaft, 6<br>Stopes, 8 | 1st class, $3 00<br>2d class, 2 50 | $15 00 | $2 50 | $1 60 | $1 00 | ...... | 7, 141 | $4 38 | 3 | $30, 561 | Two months lost placing pumps in shaft. Short of water for 3 months and did not run at full speed. |
| Sumner, Big Blue, Lady Belle, Bull Run, and 8 others. | Kernville, Kern County. | 65 | 3 00 | Shaft, 75 00<br>Winze, 12 00 | 8 00 | 2 75 | 1 75 | 400 | 12, 000 | 9 00 | 2½ | 108, 000 | Hoisting works 6 engines, 16 to 12 inch pumps. Adit tunnel 2,000 feet long, for draining 150 feet from bottom. |
| Sierra Buttes | Sierra County | 180 | *65 00 | .......... | ........ | 4 97 | 59 | ...... | 31, 580 | 6–7 | 1 | ........ | Hand-feeding to batteries. |
| Plumas Eureka | Plumas County | 200 | *65 00 | .......... | ........ | 3 55 | 45 | ...... | 57, 194 | 6–7 | 1 | ........ | Automatic battery feeders. |
| Shepley | Ophir, Placer County. | 8 | 3 00 | 12 00 | 3 50 | 2 50 | 2 00 | 300 | 2, 000 | 25 00 | 2 | ........ | |
| Belmont | ......do | 12 | 3 00 | 12 00 | 4 00 | 2 00 | 1 50 | 150 | ........ | 15 00 | 2 | ........ | |
| Gold Blossom | ......do | 20 | 3 00 | 15 00 | 5 00 | 3 50 | 1 50 | 200 | ........ | 15 00 | 5 | ........ | |
| Saint Patrick | ......do | 30 | 3 00 | 20 00 | 6 00 | 3 50 | 1 50 | 800 | ........ | 22 00 | 2 | ........ | |
| Idaho | Grass Valley, Nevada County. | 216 | 3 00 | 25 00 | 9 00 | 9 21 | ...... | 1, 200 | 28, 572 | 12 76 | ½ | 364, 599 | Water-power introduced in place of steam, saving $25,000 per annum. |
| Original Empire | ......do | 45 | 3 00 | 20 00 | 6 50 | 9 00 | 1 25 | 1, 425 | ........ | ........ | 3 | ........ | Shaft at incline of 30 degrees. |
| New York Hill | ......do | 62 | 3 00 | 25 00 | 10 00 | 15 00 | 2 10 | 1, 300 | 4, 876 | 19 00 | 3 | ........ | Produced 177 tons of concentrates yielding $62 per ton at custom works. Much dead work done. |
| Consolidated Wyoming. | Nevada District, Nevada County. | 40 | 3 00 | 15 00 | 4 00 | 3 50 | 1 50 | 700 | 6, 800 | ........ | 3¾ | ........ | Worked by tunnel and shaft. |
| Murchie | ......do | 25 | 3 00 | 10 00 | 4 00 | 5 00 | 1 50 | 720 | 7, 900 | 17 75 | 4 | ........ | Worked by shaft. |
| Nevada City | Nevada County | 33 | 3 00 | 7 00 | 2 00 | 3 70 | 1 05 | ...... | ........ | 15 00 | 3 | ........ | |

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Merrifield............ | Nevada City, Nevada County. | 45 | 3 00 | .............. | ........ | 3 00 | 1 75 | 900 | ........ | ........ | 5 | ........ | |
| Providence .......... | ......do ............ | 90 | 3 00 | .............. | 2 00 | 4 00 | 92 | 1, 100 | ........ | ........ | 7 | ........ | |
| Canada Hill, L. Charonnat & Sons. | Canada Hill, Nevada County. | 40 | 3 00 | 20 00 | 3–5 | 10 00 | 1 45 | ...... | 5, 000 | 20 00 | 2½–3 | ........ | Water-power to be introduced in 1884, will reduce milling to $1. |

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* Per month.

*Table showing operations of some of the leading quartz-mills in California during the year* 1883.

| Name of mill. | Location of mill. | Power. | Stamps. |  |  |  | Pans. | Concentrators. | Cost of mill. | Twenty-four hours capacity in tons. | Cost of treatment per ton. | Tons crushed during year. | Method of treating sulphurets. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
|  |  |  | Number. | Weight in pounds. | Drop in inches. | Drops per minute. |  |  |  |  |  |  |  |
| Patterson | Tuttletown, Tuolumne County | Water, high pressure. | 20 | 750 | 4½–5 | 85 | Drakes | Schofield |  | 30–40 | $1 00 | 7, 141 | Chlorination. |
| Sumner | Kernville, Kern County | Water, turbine wheel. | 80 | 750 | 7 | 78 | 5 | 16 | $120, 000 | 120 | 1 75 | 12, 000 | Pans and settlers. |
| Sierra Buttes | Sierra County | Water | 50 | 750 | 7¼ | 84 |  |  |  | 90 | 59 | 31, 580 |  |
| Plumas Eureka | Plumas County | do | 60 | 750 | 8½ | 80 |  |  |  | 150 | 45 | 57, 194 | Pans. |
| Shepley | Ophir, Placer County | do | 10 | 750 | 8 | 80 |  | 1 | 16, 000 | 15 | 1 50 | 2, 000 | Sold to ore buyers, value $110 per ton. |
| Belmont | do | do | 10 | 800 | 7 | 95 |  | 4 | 15, 000 | 20 | 1 50 |  | Sold to ore buyers, value $300 per ton. |
| Gold Blossom | do | do | 10 | 800 | 8 | 85 |  | 4 | 15, 000 | 20 | 1 50 |  | Sold to ore buyers, value $350 per ton. |
| St. Patrick | do | do | 15 | 750 | 8 | 80 | 2 | 6 | 15, 000 | 22 | 1 50 |  | Sold to ore buyers, value $150 per ton. |
| Idaho | Grass Valley, Nevada County | do | 35 | 850 | 9½ | 72 | Handy | Cornish | 40, 000 | 100 | *9 21 | 28, 572 | Chlorination. |
| Original Empire | do | Steam | 20 | 800 | 7 | 85 | 1 | 6 |  | 40 |  |  | Do. |
| Omaha | do | Water and steam | 10 | 800 | 9 | 70 | 1 | 4 | 12, 000 | 20 | 1 50 |  | Treated at custom works at $20 per ton. |
| Merryfield | Nevada City | Water | 30 | 750 | 7 | 90 |  | 12 | 40, 000 | 60 | 1 75 |  | Chlorination. |
| Providence | do | do | 40 | 750 | 7 | 92 |  | 16 | 56, 000 | 80 | 92 |  | Do. |
| Nevada City | Nevada County | do | 20 | 750 | 6 | 93 |  | 8 | 50, 000 | 35 | 1 05 |  | Do. |
| Wyoming | do | do | 10<br>6 | 750<br>900 | 6½ | 94 |  | 8 | 24, 000 | 26 | 1 50 |  | Do. |
| Murchie | do | Steam | 10 | 750 | 6½ | 90 |  | 4 | 15, 000 | 19 | 1 50 | 6, 480 | Do. |
| Canada Hill, L. Charannot & Sons. | Canada Hill, Nevada County | do | 10 | 750 | 7 | 100 |  | 4 Frue vanners. | 16, 000 | 10 | 1 45 | 5, 000 | Do. |

* Includes mining.

# CHAPTER IV.

## COLORADO.

The year 1883 has been one of increased activity and unparalleled prosperity in the mining industries of this State. Not only has the production of gold exceeded that of any other year, but the production of silver has exceeded by over a million dollars that of the previous year, and by over a half million the product of any previous year in its history.

Notwithstanding the decline in the price of silver and the heavy losses on lead which marked the close of the year, the reduced cost of transportation and the constant economic improvement in mining, milling, and refining have enabled those engaged in this business to reap the profits naturally resulting from this increased production. With few exceptions, the yield of the several districts was greater than in 1882, while in the vast region known as the San Juan country, embracing the counties of Hinsdale, Ouray, Dolores, San Miguel, La Plata, and San Juan, the excess was beyond reasonable expectation. This was partly due to the discovery of an extensive zone of rich veins in the Red Mountain district, situated partly in San Juan and partly in Ouray counties, which being easily accessible to railroads enabled producers to readily ship their ores to the large smelting markets. The great mines of Leadville, though handicapped somewhat by the decline in prices referred to, and by the destruction by fire of their two largest reducing establishments, maintained their prestige as the largest silver producers of the world.

According to the Denver Tribune the metallic product of Colorado, by counties, for 1883 was as understated:

| | |
|---|---|
| Boulder | $400,000 |
| Chaffee | 300,000 |
| Custer | 800,721 |
| Clear Creek | 2,000,000 |
| Dolores | 200,000 |
| Eagle | 930,000 |
| Fremont | 20,000 |
| Gilpin | 2,208,988 |
| Grand | 10,000 |
| Gunnison | 650,000 |
| Hinsdale | 390,000 |
| Lake | 15,691,200 |
| La Plata | 128,688 |
| Ouray | 700,600 |
| Park | 400,000 |
| Pitkin | 125,000 |
| Rio Grande | 182,000 |
| Routt | 75,000 |
| Saguache | 100,000 |
| San Miguel | 225,000 |
| San Juan | 418,954 |
| Summit | 350,000 |
| Total | 26,306,151 |

As in this estimate the value of lead and copper is included, the precise value of gold and silver embraced remains to be ascertained.

The same paper gives the following statement of the output of certain smelting works in the State:

*Grant Smelting Works.*

| Counties and Territories. | Lead. | Silver. | Gold. |
|---|---|---|---|
| | *Pounds.* | *Ounces.* | *Ounces.* |
| Lake | 25, 476, 950 | 2, 248, 997 | 3, 291 |
| Clear Creek | 650, 170 | 209, 274 | 308 |
| Custer | 2, 750 | 113, 733 | 29, 039 |
| Gilpin | 119, 120 | 5, 738 | 666 |
| Eagle | 3, 268, 900 | 57, 057 | 834 |
| Summit | 1, 470, 400 | 62, 213 | 199 |
| Gunnison | 440, 280 | 69, 666 | 259 |
| Boulder | 9, 720 | 4, 716 | 2, 227 |
| Chaffee | 179, 240 | 19, 086 | 147 |
| Ouray | 101, 960 | 23, 640 | 81 |
| Park | 228, 740 | 36, 972 | 660 |
| Pitkin | 284, 340 | 24, 963 | 52 |
| San Juan | 1, 366, 930 | 136, 964 | 311 |
| Saguache | 8, 800 | 1, 192 | |
| San Miguel | 39, 040 | 11, 535 | 137 |
| Colorado Ore Smelting Company | 258, 470 | 125, 238 | 426 |
| Old Mexico | 11, 440 | 2, 280 | |
| New Mexico | 11, 330 | 125, 221 | |
| Miscellaneous | 333, 170 | 36, 565 | 451 |
| Arizona | 201, 090 | 255, 918 | 74 |
| California | 18, 800 | 29, 6[illegible]4 | 479 |
| Utah | 1, 689, 500 | 75, 155 | 168 |
| Idaho Territory | 134, 160 | 16, 158 | |
| Total | 40, 290, 300 | 3, 464, 505 | 38, 217 |

Estimating the silver at $1.10 and the gold at $20.68 per ounce, with the lead at $90 per ton, we have—

| | |
|---|---|
| Gold | $764, 693 |
| Silver | 3, 819, 550 |
| Lead | 1, 813, 065 |
| Total output | 6, 397, 308 |

In this, however, are included gold to the amount of at least $14,000; silver, $175,000, and lead $98,000, or an aggregate of $287,000, which accrued from ores from other mines than those of Colorado.

*The Boston and Colorado Smelting Company.*

| County. | Gold. | Silver. | Copper. | Total. |
|---|---|---|---|---|
| Gilpin | $436, 000 | $83, 000 | $87, 000 | $606, 000 |
| Clear Creek | 44, 000 | 640, 000 | 41, 000 | 725, 000 |
| Boulder | 146, 000 | 59, 000 | | 205, 000 |
| Lake | | 56, 000 | | 56, 000 |
| Summit | | 152, 000 | | 152, 000 |
| Park | 6, 000 | 80, 000 | | 86, 000 |
| Gunnison | 3, 000 | 150, 000 | | 153, 000 |
| Custer | 9, 000 | 7, 000 | | 16, 000 |
| Hinsdale | 4, 000 | 31, 000 | 12, 000 | 47, 000 |
| Saguache | | 11, 000 | | 11, 000 |
| San Juan | 2, 000 | 16, 000 | 6, 000 | 24, 000 |
| Ouray | | 15, 000 | 3, 000 | 18, 000 |
| Chaffee | | 11, 000 | | 11, 000 |
| New Mexico | 12, 000 | 101, 000 | 11, 000 | 124, 000 |
| Arizona | | 13, 000 | 4, 000 | 17, 000 |
| Utah | 4, 000 | 88, 000 | 40, 000 | 132, 000 |
| Montana | 63, 000 | 646, 000 | 130, 000 | 839, 000 |
| Miscellaneous | 240, 000 | 417, 000 | 28, 000 | 685, 000 |
| Total | 969, 000 | 2, 576, 000 | 362, 000 | 3, 907, 000 |

This includes purchases from smelting companies, sampling works, and ore buyers, and it is impossible to tell from what districts it came. As it will be seen, however, this includes $85.000 in gold, $848,000 in silver, with $184,000 in copper from other mines than those of Colorado, leaving Colorado product of the Argo smelter as follows:

| | |
|---|---|
| Gold | $884, 000 |
| Silver | 1, 728, 000 |
| Copper | 177, 000 |
| Total | 2, 789, 000 |

It is also probable that further deduction should be made for outside products included under the head of "Miscellaneous."

*The Miners and Smelters' Works at Golden.*

| County. | Tons. | Gold. | Silver. | Copper. | Total. |
|---|---|---|---|---|---|
| Clear Creek | 2, 000 | $8, 355 | $158, 735 | $4, 261 | $171, 351 |
| Gilpin | 1, 950 | 88, 725 | 16, 740 | 11, 718 | 117, 183 |
| Boulder | 103 | 6, 000 | 1, 116 | .......... | 7, 116 |
| Other sources | 405 | 5, 885 | 28, 285 | 1, 130 | 35, 300 |
| Tailings | 2, 338 | 16, 326 | 2, 140 | .......... | 18, 466 |
| Total | 6, 796 | 125, 291 | 207, 016 | 17, 109 | 349, 416 |

*Bullion shipped.*

| | |
|---|---|
| Gold | $193, 399 |
| Silver | 277, 181 |
| Copper | 35, 100 |
| Total | 505, 680 |

The Golden Smelting Company make the following return of the ores bought by them during 1883:

| Locality. | Tons. | Gold. | Silver. | Lead. | Total. |
|---|---|---|---|---|---|
| Clear Creek | 1, 908 | $14, 400 | $261, 502 | $45, 715 | $321, 618 |
| Gilpin | 4, 359 | 137, 844 | 74, 252 | 20, 666 | 232, 763 |
| Boulder | 746 | 89, 242 | 28, 148 | 1, 316 | 118, 707 |
| Park | 126 | 32 | 5, 340 | 1, 520 | 6, 893 |
| San Juan | 64 | 411 | 5, 274 | 2, 396 | 8, 083 |
| New Mexico | 23 | .......... | 9, 838 | .......... | 9, 838 |
| All other sources | 317 | 6, 747 | 21, 116 | 8, 419 | 36, 283 |
| Total | 7, 543 | 248, 680 | 405, 475 | 79, 435 | 734, 190 |

The Royal Gorge Works at Canyon City make this return for last six months:

| | |
|---|---|
| Lake County | $84, 312 |
| Summit County | 14, 858 |
| Saguache County | 1, 920 |
| Chaffee County | 3, 455 |
| Custer County | 1, 796 |
| Gunnison County | 1, 197 |
| Pitkin County | 887 |
| Denver Ore Smelting Company | 25, 132 |
| Utah | 24, 132 |
| Miscellaneous | 2, 455 |
| Total | 142, 020 |
| Total assay value | 177, 602 |

*Mathews & Webb during the year* 1883.

| County. | Silver. | Gold. | Lead. | Copper. | Total. |
|---|---|---|---|---|---|
| Custer | $146,590 | $624,089 | $11,583 | $458 | $782,720 |
| San Juan | 288,268 | 18,350 | 66,856 | 45,368 | 418,915 |
| Summit | 51,033 | 1,560 | 43,692 | | 96,286 |
| Pitkin | 4,856 | | 1,800 | | 6,606 |
| Boulder | 1,067 | 1,281 | 119 | 9 | 2,477 |
| Park | 23,502 | 5,260 | 6,462 | 106 | 35,331 |
| Gunnison | 88,226 | 2,579 | 37,062 | | 127,868 |
| Gilpin | 8,301 | 5,140 | 1,165 | 598 | 15,205 |
| Ouray | 4,027 | 24 | 850 | | 4,903 |
| San Miguel | 35,678 | 8,301 | 3,971 | | 47,851 |
| Eagle | 42,121 | 9,712 | 108,351 | | 116,186 |
| Clear Creek | 28,009 | 3,472 | 6,280 | | 37,762 |
| Arizona | 31,710 | 4,274 | 951 | 113 | 37,040 |
| New Mexico | 5,060 | | | | 5,060 |
| Mexico | 1,105 | 82 | 561 | | 1,749 |
| Miscellaneous | 5,489 | 1,043 | 517 | 245 | 7,295 |
| Total | 771,149 | 685,076 | 290,227 | 468,980 | 793,352 |

The mining journals give the dividends paid by the mining companies of the State during the year as follows:

| Companies. | Dividends. | Amount. |
|---|---|---|
| Amie Consolidated | 1 | $25,000 |
| Bassick | 2 | 200,000 |
| Boreel | 1 | 18,000 |
| California | 1 | 7,500 |
| Carbonate Hill | 2 | 60,000 |
| Central | | 60,000 |
| Colorado United | 1 | 16,250 |
| Catalpa | 1 | 30,000 |
| Dunkin | 1 | 10,000 |
| Evening Star | 2 | 50,000 |
| Gem | | 7,500 |
| Glen | | 3,000 |
| Granite | | 3,750 |
| Henrietta | 1 | 27,000 |
| Iron Silver | 3 | 300,000 |
| Little Chief | 1 | 20,000 |
| Leadville Consolidated | 4 | 80,000 |
| Morning Star | 3 | 75,000 |
| Prussian | 1 | 15,000 |
| Silver Cord | 3 | 225,000 |
| Smuggler | 3 | 42,000 |
| United Gregory | | 12,000 |
| Total | 31 | 1,287,000 |

As somewhat of a guide in arriving at the deduction to be made for the value of the lead in Colorado's production the following statement of the production and fluctuation in the market price of that metal is given. It is from "Powell's Mineral Resources of the United States."

"The production of Colorado for four or five years past has increased very rapidly. The production in 1877 was 897 tons; 1878, 6,397; 1879, 23,674; 1880, 35,674; 1881, 40,547; 1882, 58,642 tons. The lead production of Leadville is stated as follows: 1877, 175 tons; 1878, 2,324 tons; 1879, 17,650 tons; 1880, 33,551 tons; 1881, 38,101 tons; 1882, 39,864 tons. The production of Utah shows a yearly increase of 20 to 30 per cent. Nevada's production for 1882 exhibits a decline of 33 per cent. compared with the previous year. The Mississippi and Missouri Valleys disclose a very small increase each succeeding year.

"The average price of lead during 1875 was about $5.90, and in 1876 $6, without any market fluctuations. In the beginning of 1876 lead sold at $6.12 and declined gradually, selling at the close at $4.56. The average quotations for January of 1878 were $4.25; the price from this time forward declined gradually until September, during which month the highest price was $3.45. From September to the close of the year a slight but steady advance occurred, and the metal at the close of the year was quoted at $3.95. During 1879 the production of Colorado influenced the market, and from $4 at the opening of the year, the metal declined rapidly until May, when it attained its lowest known price, viz, 2⅞ cents per pound. It rallied again rapidly, however, and the end of the year found it at $5.55. In January of 1880 lead attained $6.10, declining steadily during the next twelve months, and selling at from $4.25 to $4.50 during December. During 1881 repeated heavy purchases sustained fair prices, and the lowest sales for the year were at $4.25 and the highest at $5.25. In 1881 the prices fluctuated between $4.55 and $5.15, closing in December between $4.50 and $4.95. The price of lead in January of the present year ranged from $4.60 to $4.70, declining gradually until June, during which month fluctuations were confined to $4.40 and $4.45. Since that time the decline was easy at first, then with a rapidity that was only equaled in the spring of 1879, until at present the metal appears to be a drug in the market at $3.70."

The following history of the smelting institutions at Golden will be found of interest:

The Miners' Smelting and Reduction Company treat ores for the purpose of extracting gold, silver, and copper. The plant consists of five reverberatory furnaces, seven calcining furnaces, two fine or metal calcining furnaces, two copper furnaces, one leaching room with tubs, vats, and tanks for the extraction of silver by the Ziervogel process, two crucible or pot furnaces, machinery for crushing and pulverizing, such as crusher, rollers, ball-mill, &c. Daily capacity, 50 tons. The building of the works was commenced in July, 1881, and in November the first shipment of silver bars (998 fine) was made. Since then, and up to July 1, 1882, $350,000 worth of gold and silver bullion and $89,000 worth of copper have been produced and shipped. Over 8,500 tons of gold, silver, and copper ores, with a valuation of $700,000, were purchased by the company, and in the neighborhood of 11,000 tons of coal consumed in the different operations. Seventy men are employed. Stock of ore on hand July 1 valued at $220,000; other products valued at $50,000.

| Reduction by lead process. | The Golden Works. | The Valley Works. |
|---|---|---|
| Tons of ore treated | 9,124 | 7,900 |
| Tons of coal used | 3,050 | 2,960 |
| Tons of coke used | 1,500 | 1,497 |
| Tons of limestone used | 700 | 1,019 |
| Tons of scrap-iron used | 175 | ............ |
| Value of gold produced | $190,587 28 | $155,960 00 |
| Value of silver produced | 495,965 32 | 421,440 80 |
| Value of copper | 30,000 00 | 19,071 54 |
| Value of lead | 104,889 60 | 21,359 16 |
| Total | 821,442 20 | ............ |

I have estimated the production of Colorado during the calendar year 1883 to have been: Gold, $4,100,000; silver, $17,370,000; total, $21,470,000.

The value of the silver has been calculated at its coining value, in standard silver dollars, $1.16$\frac{4}{11}$ per standard ounce, or $1.2929 per ounce

This estimate is based upon the amount purchased by the Government for coinage, and exported and compared with the reports of refineries which have reduced it, railroads and express companies which have shipped it, and bullion dealers who have handled it.

The following shows the approximate production by counties:

| County. | Gold. | Silver. | Total. |
|---|---|---|---|
| Boulder | $300,000 | $160,000 | $460,000 |
| Chaffee | 50,000 | 265,000 | 315,000 |
| Clear Creek | 250,000 | 1,580,000 | 1,830,000 |
| Custer | 620,000 | 200,000 | 820,000 |
| Dolores | 5,000 | 250,000 | 255,000 |
| Eagle | 70,000 | 300,000 | 370,000 |
| Fremont | ............ | 20,000 | 20,000 |
| Gilpin | 1,650,000 | 200,000 | 1,850,000 |
| Gunnison | 100,000 | 650,000 | 750,000 |
| Hinsdale | 20,000 | 250,000 | 270,000 |
| Lake | 400,000 | 11,700,000 | 12,100,000 |
| La Plata | 13,000 | 5,000 | 18,000 |
| Ouray | 20,000 | 500,000 | 520,000 |
| Park | 200,000 | 175,000 | 375,000 |
| Pitkin | 2,000 | 55,000 | 57,000 |
| Rio Grande | 180,000 | 10,000 | 190,000 |
| Routt | 40,000 | ............ | 40,000 |
| Saguache | 5,000 | 100,000 | 105,000 |
| San Juan | 35,000 | 350,000 | 385,000 |
| San Miguel | 125,000 | 250,000 | 375,000 |
| Summit | 15,000 | 350,000 | 365,000 |
| Total | 4,100,000 | 17,370,000 | 21,470,000 |

The following review of the operations in mining for the precious metals in the several counties of the State during the year 1883 was principally prepared by Mr. Herman Silver, assayer in charge of the Denver mint, and Mr. Bradley, his assistant, to whom he had assigned the collection of the necessary information. From fuller information I have varied the estimates in some instances from Mr. Silver's figures, but his work was performed so thoroughly that but few additions or changes have been made.

## BOULDER COUNTY.

Boulder County, justly celebrated for its rich tellurium veins, lies north of the center of the State, in what are termed the foot-hills of the Rocky Mountains. The county is divided into eight principal mining districts, viz, Caribou, Gold Hill, Magnolia, Sunshine, Sugar Loaf, Salina, Crisman, and the Central mining districts. The mineral deposits are extensive and embrace a wonderful variety, the tellurium veins being the most celebrated. The lode veins should be classed under three heads—gold, silver, and tellurium, the latter carrying both the other metals. These, as a general rule, are true fissures, having well-defined walls, commonly occurring either in gneiss or granite rock, or between the two. The placers have been worked more or less every summer since their discovery, and have been generally self-sustaining. In 1859–'60, and for several years afterwards, some gold-bearing lodes were worked, but it was not until 1869, when Samuel Conger discovered the Poorman, and William Martin and George Lythe the Caribou, that mining in Boulder County received an impetus, and has steadily increased its production of the precious metals. Other mines from which ore was sold in 1869–'70, were the Idaho, Trojan, Boulder County, No Name, Sherman, Spencer, and Seven-thirty.

Three years later Prof. J. Alden Smith, while testing ores from the

Red Cloud mine on Gold Hill, demonstrated the presence of gold in large quantities, none of which could be saved by the stamp-mills. After further investigation he found the same to contain tellurium. The true character of this ore being known, prospectors again returned to this district, the result being the discovery of the Cold Spring, American, Slide, Keystone, Magnolia, John Jay, Melvina, and others too numerous to mention. This tellurium belt of Boulder County is about 20 miles long and several wide; the crevices are of good size, but the pay streaks are narrow. Some of the leading mines show continuous veins several inches wide of very rich ore, sometimes widening into pockets and often bordered by a lower grade of ore, which, by concentrating, is made marketable. The combinations of tellurium are many, the most important of which are sylvanite and petzite, native or pure tellurium being rarely found.

This district contains many gold-bearing veins not carrying tellurium, the most prominent being those on Golden Age Mountain. The ores are mostly free milling and extremely rich, but the veins, as in the case of tellurium, are narrow, and almost as large a force is required to assort and hand-dress the product as to mine it.

In the vicinity of Jamestown quite an extensive deposit of galena was discovered in 1882. A few mines are now extracting pay ore. On account of increase of richness in the ore as depth is gained, development will probably make this district an important one in Boulder County production.

*Central district* is the largest mining district in the county. and at present the most northerly; but it is likely that the rich deposits found in the northwestern part will cause that section to be organized into a separate district, that of Saint Vrain.

Jamestown is the principal town, situated at the junction of Little and Big James Creeks, 14 miles from Boulder, the county seat. In this vicinity there are seven mills.

The Pell, which was the first one erected, was improved during the year and its capacity increased; the old 6-stamp battery was replaced by ten new stamps; a new engine also was erected.

The Willard mill, now known as the Crocker, employs the Crocker process, which so far has not met the expectations of the owners.

The Golden Age mill, run by water power, is supplied with twenty-five stamps, and during the season made a seven months' run with excellent results.

The old Spanish mill, owned by George Batcheler, has four arrastras, but has not been in operation.

The Simpson mill has five stamps andtwo Frue vanners.

The Buena and Governor Group mills have excellent water power. They were erected to treat the ores by the Robinson process, which proved to be a failure, and they are not running.

At Balarat, 4 miles northwest of Jamestown, is the Smuggler mine. The Smuggler is the great representative tellurium mine of the country. The ore is principally a sylvanite. In the vein is a streak of ore that mill-runs $12,000 per ton, and the average of the smelting ore is $500 per ton. In addition there are large bodies of milling or concentrating ore averaging $40 per ton. Of this there are on the dump and in sight in stopes many thousand tons, estimated at from $300,000 to $500,000. The vein averages 5 feet, the high-grade tellurium 6 to 12 inches, the balance of the vein filling being the concentrating ore just mentioned. Since the discovery of this vein in 1877 over $400,000 have been extracted. The future will witness a large production, as the smelting-ore chutes were lost in the 100-foot level and have again appeared on the 300 and 350 foot levels. The developments consist of a working shaft 400 feet deep and an air-shaft 250 feet northwest with a depth of 200 feet. Levels are run each way from shaft at every consecutive 50 feet; the aggregate of these is 3,000 feet. Below the 100-foot level no stoping has been done; above that to the surface the entire vein filling is removed.

The Saint Julian, running parallel with the Smuggler, is a tellurium vein 4 feet in width, with pay streak of from 4 to 8 inches that will average $200 per ton. The shaft is 75 feet deep, at the bottom of which levels are being run, but no ore extracted except that removed in developing.

The other prominent claims in this immediate vicinity are the El Dorado, Careless Boy, Mountain Queen, and Black Prince.

Camp Providence is about 4 miles above Jamestown, on Big James Creek. Here there are several famous telluride mines, which, for the amount of work done on them, have produced a large amount of high-grade ore.

The John Jay has produced some $95,000, taken from a shaft 260 feet deep and about 500 feet of level; for some time it was idle, but is again in active operation. The mill is being enlarged, and will in 1884 add to the bullion product. The mine is a fissure vein from 5 to 9 feet wide.

The Last Chance, near by, is a parallel vein, from which a large amount of very rich ore has been mined. It is very similar to the John Jay, and has had about the same history.

The Ten Forty is about a mile below the Last Chance; the ore is different in character, being silver contained in sulphurets and gray copper with galena. The vein is large, and is being developed by an adit now in some 340 feet; the ore is high-grade, and so far has been found in chimneys.

At Springdale, 1½ miles from Jamestown, the ores are of the tellurium order.

Among the prominent mines are the Rip Van Dam, Ellen, Standard, Ocean Wave, Grand Central, Big Blossom, Gladiator, Twin Blossom, Lily of the West, Earl, Rambler, King William, Badger, Grand Union.

The Rip Van Dam is developed by a tunnel 100 feet on the vein; near the upper end of the claim on the mountain is a shaft 55 feet; near the center one of 25 feet, and an adit of 30 feet. The high-grade streak runs from 2 to 10 inches, while the concentrating ore is in a crevice of from 2 to 3 feet.

The Ellen, on this same vein, has 3 shafts, 75, 50, and 50 feet, respectively, with one level of 25 feet and a drift 25 feet. The width and character of pay streak and concentrating ore are similar to the Rip Van Dam. Considerable ore extracted during 1883 remains on the dump, the estimated value being $3,000.

The Standard possesses a shaft 25 feet deep, three tunnels on the vein, one 90 feet, one 100 feet, and another 170 feet long, from which is a drift 90 feet.

The Ocean Wave has not been worked during 1883, the developments consisting of prospect holes at five different places on the vein and a tunnel 30 feet.

The Grand Central, in Castle Gulch, has been opened by a tunnel 275 feet, disclosing a pay streak of high-grade tellurium and about 3 feet of concentrating ore, of which there are about 300 tons now on the dump.

The Big Blossom, near the Grand Central, has 4 shafts, 90, 60, 30, and 10 feet deep, with one level 50 feet and several cross-cuts. The pay-streak contains telluride ores, being from 2 to 8 inches in width. The concentrating crevice about 3 feet.

On the Golden Age Mountain are the Golden Age, Warrior, Colfax, December, &c.

The Golden Age is about 2 miles from Jamestown and located at an elevation of about 8,500 feet. It is a contact vein, with a northeastern and southwestern strike, and dips 45° south. It is owned by the Golden Age Company, and is under the management of D. H. Pike, who has made the mine a steady producer from the day of its discovery. This vein from the surface has produced free gold, increasing in quantity as depth is gained. The developments are an incline of 260 feet, a main shaft of 340 feet, and about 1,200 feet of levels and cross-cuts. Upon the surface are large ore, shaft, engine and boiler houses, the hoisting machine and machinery being of the best make.

The Warrior is a free-gold mine, with a pay streak from 3 to 8 inches. A shaft 64 feet has been sunk, which during the spring will be pushed to a depth of 100 feet, when the levels will be run.

The December lies a short distance north of the Golden Age, and is owned by the December Mining and Milling Company, limited, of Philadelphia. The developments are three shafts. No. 1 is 100 feet deep, with levels east and west at 50 and 100 feet; the 100-foot level east at 25 feet shows a body of 4 feet of fine galena with a free-gold streak. Shaft No. 2 is 50 feet in depth, and has exposed a vein of galena about 2 feet wide giving returns of 71 ounces silver and 25 per cent. lead. Shaft No. 3 is 25 feet deep, showing body of ore similar to that in the other workings.

The Colfax mine and 10 stamp mill is situated in Central Gulch, just below the December. Frue vanners have been put in the mill, and sufficient ore run to test its value as well as demonstrate the utility of the vanners. This mine is advantageously located, being easy of access at all seasons, has plenty of good timber at hand, and is a large, well-defined contact vein, varying from 2 to 12 feet in width. The development consists of several 10 feet holes along the vein and one 100-foot shaft, with 150 feet of levels, all in ore. Assays and mill-runs give from $10 to $150 per ton.

The Princess is situated in Central Gulch, below the Colfax, and shows a fine body of galena, with a separate streak carrying leaf gold in brown quartz, the galena giving returns of from 40 to 50 ounces silver per ton and 60 per cent. lead, while the gold-streak gives $800 per ton. Some drifting has been done, but since the price of lead has declined this property has not been worked.

The Encounter, Morning Glory, Buckey, Nolens, May Queen, and Cheap John are all free-gold lodes, situated in Central Gulch, are all good prospects, on which assessment work only has been done during the past year.

The Hidden Treasure is in the same vicinity, from which some high-grade ore is now being mined; has a shaft 48 feet deep, and some drifting with surface work, consisting of 10 feet holes and open cuts.

The Pet mine is in the same locality, and has the same general character. At one time it was a large producer, the ore being treated in the old Spanish arrastra. It is developed by a shaft 60 feet in depth.

The Romance is situated near the Princess. The ore is free gold, with a pay streak varying from 1½ to 3 feet in width. This property has furnished some of the rarest specimens of free gold taken from the ground in Colorado. Its development consists of a main shaft about 90 feet deep and several surface openings, all showing a well-defined vein.

The Big Thing is situated on Little Jim Creek, one-half mile above Jamestown. The ore is galena, iron and copper pyrites, which gives returns of from 30 to 75 ounces silver and ½ to 1½ ounces gold per ton, with from 30 to 60 per cent. lead. This property has been greatly improved the past year; a shaft-house has been built and steam hoisting works of the most approved pattern erected, and the mine has been cleaned out, retimbered, and put in first-class condition, and a large amount of ore raised and shipped to Denver.

The Argo is situated about 200 yards north of the Big Thing, and has the same character of ore. This mine has been famous for its pockets of rich ore. During the year the main shaft has been sunk some 75 feet, and some drifting has been done, all in ore, that shipped to Denver gave from 22 to 84 ounces silver per ton, and 30 per cent. lead. In the immediate vicinity are a number of more or less promising prospects in various stages of development, showing the same general character as the two preceding mines.

The American is situated in Elk Horn Gulch, about 1 mile northwest of Jamestown. It is well developed by shafts, levels, and an adit 150 feet in length, showing a crevice from 5 to 8 feet in width, carrying a large body of quartz and iron pyrites which runs for first-class ore from $100 to $320 per ton, and for second-class from $20 to $40.

The Stanley lies adjacent to the preceding, and is similar in character; has a large, well-defined vein opened by a shaft 40 feet deep and an adit 75 feet in on the vein.

The Mineral Point lies across the main gulch, and is in on the same vein. It is an older location on which more work has been done, and from which a large amount of pay ore has been extracted.

The La Loma, Potosi, Gold Dirt, and several others in the same vicinity are prospects only, and are in various stages of development.

The Buena mine is situated on the divide between Big and Little James Creeks, and is about one-half mile west of Jamestown. It is owned by the Buena Gold Mining Company, and has produced considerable ore during the year. The ore is a telluride showing sylvanite, calaresite, and petzite. The highest mill runs have been 215 ounces gold per ton, and 33 ounces silver. The developments consist of three shafts 90, 60, and 40 feet deep, respectively, and a cross cut tunnel 307 feet that cuts the vein on which 210 feet of levels have been run. Most of the ground above the 50 foot level has been stoped; the lower levels have been worked but little.

The Niagara is situated on Buena Mountain, 3½ miles from Jamestown, and was located in 1882. The vein is from 1 to 4 feet, with a pay streak of from 4 to 8 inches of quartz, carrying tellurium and free gold which runs when sorted $50 to $100 per ton. The mine is developed by a shaft 45 feet and about 100 feet of levels. After being idle some months, work is again being pushed on this property, and some very high grade ore has been raised.

The Baltimore Belle is situated on Baltimore Belle Mountain, 3½ miles west of the Buenas. The vein is a fissure, showing a crevice 3 feet in width, with a pay streak of from 6 to 20 inches of first-class ore, giving returns ranging from $966.95 to $10,246.95 per ton, while second-class ore will average $75 per ton. The developments consist of one main shaft 76 feet deep, one shaft 30 feet, with drift at bottom running 50 feet west, and connecting with main shaft for air purposes. West of the shaft a cross-cut has been run, cutting the vein at a depth of 18 feet; there are also good and substantial shaft and ore houses with improved horse-power hoist. The mine has not been in operation, although everything is in good shape for work, and there is a large amount of ore on the dump.

The Wealth Group consists of the Equator, Forest, Wealth, and Pewabic lodes, which are in various stages of development.

The Gordon Group of mines is situated southeast of Jamestown 1½ miles, on the divide between James and Left-hand Creeks, and consists of ten lodes, the Governor, President, Charter, Denver View, Fannie H., Star of the North, Philadelphia, Jamestown, Annex, and Junction, on which considerable work has been done, consisting of shafts, tunnels, and adits. One of the latter is a cross-cut, and is 650 feet in length. These veins vary in size from 3 to 15 feet. The ore consists of various combinations of tellurium, with gold, silver, and lead, sulphides of silver, copper, iron, zinc, and lead, the copper and iron carrying both gold and silver.

The Stanislaus is situated on the main James Creek, about 1 mile from the town. The ore is galena, with copper and iron pyrites, carrying both gold and silver; the vein is large and well defined and has given results of $348 per ton. The mine is well situated for convenient and profitable working, and when work is systematically conducted it will without doubt be a valuable property.

The S. B. lode is situated half a mile north of Jamestown. The development the past year consists of drifting and sinking. Considerable ore has been mined and treated in various ways with varying results.

The Gold King is near the preceding mine, and is of the same general character. The vein, though apparently large, is considerably broken. Sufficient work has not yet been done to demonstrate whether the true vein has been opened, though some of the ore has run $484 per ton in gold. The development is one main shaft 115 feet deep, one adit 100 feet and one 50 feet in length. Many rare and valuable specimens have been obtained from this mine.

The Dan Tucker lode on Kangaroo Hill, near the Governor Group, is developed by two shafts, 40 and 20 feet respectively, showing a pay streak 16 to 20 inches wide of a gold-bearing quartz that averages $120 per ton. This vein promises large returns upon reasonable development. About 2 miles south of the Golden Age mine is the Blue Jay Group, composed of the Blue Jay, Gus Barnes, Lead Silver, and Saint Louis, all on Blue Jay Hill, in one of the most promising positions of the recently determined lead deposits.

The Song Bird combination is composed of the Song Bird, Silver Cord, Northern Light, and North Side, four contiguous and overlapping claims, embracing about 12 acres. On these veins are numerous shafts, adits, open cuts, and a cross-cut tunnel, commenced this year, is now 15 feet in from starting point in Song Bird Gulch. This will cut all these veins at considerable depth, and is now approaching the Song Bird vein, which will be cut at 225 feet depth. The width of veins shown by recent developments is from 30 to 40 feet. The character of the ore is lead carbonates, galena, and black sulphurets that assay on an average $125 per ton.

The Mermaid, on Mermaid Hill, is a large tellurium vein about 15 feet wide. It is developed by two shafts 10 and 15 feet, and a tunnel on the vein from Mermaid Gulch 60 feet from the starting point, showing the vein in the breast of the tunnel. The ore averages $40 per ton.

On Little Jim Creek the Semiramis and Veto, two adjoining locations, are being developed by two shafts and two adits which disclose good veins of argentiferous galena.

The Invincible is developed by a shaft of 105 feet; two levels 20 feet each are run from this at a depth of 40 feet. The vein carries sulphurets, copper, and iron pyrites, and galena, also tellurium found in pockets.

The Buckhorn is one of the largest silver producers in this county. The value of the ore is very equally divided between gold and silver; the character of the ore being a fine-grained galena which is mixed with quartz gangue. This property is developed by a shaft 155 feet deep. At each consecutive 50 feet from the surface-levels are run each way on the vein that aggregate 382 feet.

*Gold Hill district.*—The Bella, near Gold Hill, is now a producing mine. The developments consist of a shaft 75 feet deep, 300 feet of levels on the vein, and a cross-cut 100 feet, with 30 feet of stoping. The property is now equipped with first-class machinery, T-rails, and cars, in good condition for a large output.

The Mountain Chief mine is showing up well. A tunnel was driven 700 feet to connect with the main shaft. This disclosed a rich pay-streak of ore.

The Victoria mine has a shaft 250 feet deep; at 75 feet is a drift to the east 150 feet; at 120 feet is one to the east 85 feet; at 175 feet one east of 40 feet and west 60 feet, and at 230 feet, one east 40 feet and west 30 feet. The east workings are 500 feet from the main shaft and consist of a 125-foot shaft, with levels east and west, 130 feet east at a depth of 55 feet, while at 100 feet there are two more levels east and west of 20 feet each. Altogether the Victoria has over 1,100 feet of development, with much ground yet to stope. The ore is gray copper in a 3-foot crevice, with an average of 12 inches of pay.

The Vulcan, on Gold Hill, is a large vein of free-milling gold ore, the average value being $70 per ton. The developments consist of a shaft 50 feet deep, at the bottom of which are levels 30 feet in length, and two other prospecting shafts 40 and 10 feet deep, respectively.

The Prussian, located on the left-hand slope of Gold Hill, is developed by a shaft 380 feet deep and six tunnels aggregating 2,600 feet. Since 1879 this mine has continued to produce a high-grade tellurium, in addition to a large quantity of galena and gray copper.

The Slide mine, owned by the American Consolidated Mining Company, is the representative deep mine of Boulder County, and the one which proves that tellurium ores are not found only at the surface. This mine has a shaft 661 feet deep, which at 500 feet below the surface is cut by the Corning tunnel, 700 feet in length. There are about 2,000 feet of levels and 300 feet of winzes in the mine. While considerable stoping has been done, as yet no ore has been taken out between the 400 and 650 foot levels. A 50-horse-power engine and hoister, shaft and ore houses, help to make one of the best equipped mines in the State. The Slide has been for years a heavy producer, and has over $300,000 worth of ore now in sight, the estimate having been made by competent judges. General William L. Campbell, of Denver, is the general manager of the mine, and it is superintended by Mr. J. R. Luxen.

The Horsefal has been worked steadily during the year, with flattering results. Levels have been run at 200 and 230 feet, where the ore has increased in richness.

The Van Buren is developed by a tunnel 200 feet long connecting with a shaft of 65 feet in depth. The pay streak of 2 to 9 inches is rich in gold. No ore has been shipped from this property; a large quantity low-grade ore remains on the dump, while the rich ore has been sacked.

The Black Cloud has shipped but very little during the year, although the ore in sight blocked and ready for stoping is estimated at a value of $100,000. The aggregate amount of development is about 1,800 feet in shafts, tunnels, drifts, and winzes. It is opened by three drifts from the gulch, the main tunnel being 500 feet long. The character of vein filling is gray copper and galena—the galena predominating, carrying about 3 ounces gold per ton.

The Morning Glory has a 4-foot crevice, with a solid pay streak of from 1 to 5 inches. The ore is gray copper, with galena, sulphurets of silver, iron pyrites, and zinc blende. The shaft is 82 feet deep. At a depth of 25 feet is a drift running southeast 143 feet; on this drift the ground is stoped to the surface for a distance of 100 feet. Another drift to the southeast, at a depth of 75 feet, is 31 feet long, in which no stoping has been done, and to the southwest, at this depth the drift runs 78 feet, from which was stoped a block 15 by 50 feet.

On the Ingram nothing has been done, while the Melvina has been working steadily. The main shaft is 500 feet deep, the drifts aggregating over 1,000 feet, and the amount of stoping is hard to estimate. The character of the ore is free gold and tellurium.

The Richmond, the east extension of the Melvina, is developed by a shaft 100 feet deep. At the depth of 50 feet is a drift 45 feet long, running southeast on the vein. At the bottom the vein is from 6 to 7 feet wide, in which is a good ore streak. The character is similar to that of the Melvina.

The Emancipation, between Salina and Sunshine district, has been worked steadily during the year. The shaft is 300 feet deep, and drifts have been run at every 50 feet, aggregating 500 feet. The crevice is 3 to 12 feet wide; the pay streak 1 to 20 inches.

The Napoleon, directly above the Emancipation, has a crevice about 2 feet wide, with two pay streaks, each about 5 inches in width. The developments consist of a tunnel 46 feet long, and 4 shafts 10, 11, 15, and 40 feet deep, respectively. The ore is tellurium and free gold.

The Eldorado, a mine possessing a good pay streak, has not been worked during 1883.

At Crisman, G. B. Williams is working the Yellow Pine, which consists of a double group of claims, Yellow Pine, Duroc, Gray Copper, Vancluse, and Mitchner. Beginning on the Yellow Pine, at the top of the mountain and head of the gulch, there is a 75-foot tunnel from the discovery shaft, which is 20 feet deep. Below this is tunnel No. 1, in 50 feet. All ore above No. 1 has been stoped out. No. 2 tunnel is 200 feet in length, and is connected with No. 1 by a shaft of 80 feet. No. 3 is 400 feet, No. 4, 300 feet, the two connected by a 70-foot shaft. In No. 3 is also a 50-foot shaft, and in No. 4, one of 100 feet in depth, from which are two drifts, 20 and 30 feet. No. 5 tunnel is in 300 feet and connects with the Duroc tunnel of 200 feet, which also opens on the surface by a shaft of 75 feet. All the above development is on the Yellow Pine, Coercion, and Duroc lodes.

On the Gray Copper are tunnels 50, 130, and 170 feet, with some stoping from each, and a shaft of 50 feet.

The Vancluse has three tunnels over 300 feet each, and one below them of 400 feet.

The Mitchner is now extensively developed.

There are four tunnels and ore-houses on the Yellow Pine, one on the Vancluse, and two on the Gray Copper.

The ore is a gray copper and sulphurets of silver. The shipments from the Gray Copper average 300 ounces silver; from the Yellow Pine, where the sorting is not so carefully done, 200 ounces. Altogether, all ore sold thus far has averaged 250 ounces, and some lots run 2,000 ounces and over.

This group of mines have paid all the heavy expenses of development, construction of wagon-roads, erection of buildings, &c. Mr. G. R. Williamson, the owner, began the work of locating and developing in 1873, and has employed, on an average, 30 men all the time.

The News Enterprise, near the Yellow Pine, is developed by a tunnel 200 feet long, and two shafts, one 50 feet the other 100 feet deep. The ore is a telluride carrying considerable gold.

At Magnolia are the Senator Hill and Ophir, adjoining claims. The two have over 500 feet of development besides the stoping. There are six different shafts (the deepest being 130 feet) opening the vein for 600 feet upon the surface. The ore is a high-grade tellurium found in a pay streak of from 2 to 20 inches. Besides this is 3 feet of concentrating ore.

The Rebecca is developed by two shafts. The discovery shaft is 80 feet deep, showing a pay streak of tellurium ore from 4 to 6 inches in width; the balance of the vein, 30 inches, is a good concentrating ore. One hundred and twenty-five feet west of the discovery shaft is a shaft 120 feet deep, showing the same character of vein. In this shaft, at 50 feet, levels have been run each way, opening a good ground for stoping.

In *Sugar Loaf district* the Matt vein is worked by two shafts, one 50 feet, the other 75 feet deep. On the 75-foot shaft is a drift 120 feet long. In this considerable stoping has been done, and a good grade of ore extracted.

The Freyburg is developed by a shaft 83 feet deep, with a tunnel 250 feet long, connecting with the bottom of the shaft.

The Franklin has 600 feet of development in tunneling and drifts. About 30 fathoms of ore have been stoped, but still a large body of mineral remains in sight.

The Emerson, east of Four Mile Creek, is developed by a tunnel on the vein 100 feet long; a shaft 140 feet deep, from which a drift 150 feet long has been run.

G. P. Wood has been working the William Germain, Phillips, and the G. P. Wood placers with considerable success. On the William Germain placer is an open cut of about 700 feet, about 300 feet of bedrock being exposed. The Phillips placer is opened for 450 feet, and the G. P. Wood placer 600 feet. These placers are worked by a flume, and considerable gold was extracted during 1883 and sent to the mint at Denver.

In *Ward district* the Celestial mine is developed by a shaft 100 feet deep, from which levels are run at a depth of 50 and 100 feet. In the 50-foot levels for 65 feet west and 45 feet east of the shaft the ground has been stoped, but in the lower levels, which are 65 feet, no stoping has been done. About 70 feet west of the 100-foot shaft is another 65 feet, at the bottom of which levels have been run, and here again much stoping has been done. The vein is opened on the surface for 900 feet, showing a 20-inch streak of good free-milling ore. The property is well developed, and with a concentrator in its immediate vicinity would be a large producer.

The Catham has a 3-foot crevice, with a pay streak 12 inches. The ore is low grade.

The Ni Wat and Nelson, two mines that formerly were large producers, have not been working during the year.

The Caribou, in *Caribou district*, which has always been one of the largest producing mines in this county, was not worked during the year, and has, according to the Boulder Herald, been gradually filling up with water. The pumps were taken out and the mill closed.

The Poorman has been producing regularly. The shaft has been sunk to 550 feet; the crevice is 3 feet wide, with pay streak from 6 to

8 inches in width, of solid mineral, which will run 200 ounces of silver per ton. The Poorman was the first silver lode worked in this county, and since its discovery has been a steady and profitable producer.

Messrs. H. A. Haskin, of Jamestown, J. T. St. Clair, of Gold Hill, and G. R. Williamson, of Boulder, have furnished valuable information relative to the mines and their production.

Special reports were received from the superintendents or owners of the following mines: Black Cloud, Bella, Buena, Buckhorn, Century Consolidated, Colfax, Celestial, Golden Age, Grand Central, Horsefal, Gray Copper, Morning Glory, Matt, News Enterprise, Napoleon, Poorman, Rip Van Dam, Standard, Smuggler, Saint Julien, Vancluse, Volens Washburn, and Yellow Pine, and also from the G. P. Wood, Phillips, and William Germain placers.

The News and Courier publishes, under date of January 12, 1884, the production of Boulder County for the year 1883, as follows:

| | |
|---|---|
| Product of ore sold by the Boston and Colorado Smelting Company | $200,000 |
| Golden Smelting Company | 112,000 |
| Shipped by National State Bank | 42,000 |
| Shipped by First National Bank | 8,000 |
| Total | 362,000 |

To the above must be added the amount of ore shipped out without being handled at the sampling works in this town, which includes the whole product of the Slide mine; also gold sold at the Denver mint, which includes about $10,000 sent down by Colonel Phillips; also ore and bullion of this county's product shipped from other points. The whole product will aggregate about $500,000.

Mr. Williamson kindly furnished the following from his mines:

| | |
|---|---|
| Product of Mitchner | $322 56 |
| Gray Copper | 2,586 31 |
| Yellow Pine | 31,253 56 |
| Total | 34,162 43 |

The above is the gross bullion product of the ore, the net receipts of which was, $33,969.17.

From the estimate furnished by Mr. Silver, the amount reported to have been handled by smelters and reduction works, carefully compared with the shipments of the railroads and express companies, and the reports of the mines themselves, I have placed the production of this county for 1883 at, gold, $300,000; silver, $160,000; total, $460,000; an increase of about $40,000 in gold. This shows a falling off of $150,000 in silver, a net reduction of $110,000 from 1882.

## CHAFFEE COUNTY.

Chaffee County was organized from the southern portion of Lake County in 1879. It embraces that part of the Upper Arkansas Valley, between Poncha Pass and a point a little north of the Granite. On the east are the Park Range and other mountains, and on the west it is divided by the Saguache Range from Gunnison County.

In 1860 the gold seekers first appeared along the Arkansas River, the result of which was the prosperous camp of Granite. The streams yielded considerable gold dust, especially Cache and Colorado Creeks. In 1867–'68 there was some lode mining, but subsequent to that time, until 1880 the gold production was small.

The county is divided into Granite, Hope, Clear Creek, Cottonwood, Chalk Creek, and Monarch districts.

*Granite district* produces mostly gold. The placers are rich, and pay well when worked. But little attention has been paid to working lode claims, but the indications now point to the systematic development of this class of mining. The ore, though refractory, when concentrated, will leave a margin to the miner.

*Hope district* lies west of Granite; the lodes are mostly gold bearing, and have received but little development. Considerable placer mining has, however, been done here, and quite an amount of gold mined in the gulches; the most prominent company being the Twin Lakes Hydraulic Gold Mining Company.

*Clear Creek district* is south of Hope district, extending from the Arkansas River west to the summit of the range dividing Chaffee from Gunnison County. The district has labored under many difficulties, but sufficient development has been done to prove the richness and extent of its mines. There have been many important strikes in 1883, the effects of which will be felt next summer in ore shipments. The most important mining camps in Clear Creek district are Vicksburg and Winfield.

*Cottonwood district* lies between Clear Creek district on the north and Chalk Creek on the south, extending from the Arkansas River to the Gunnison County line. In the vicinity of Buena Vista, the chief town in this district, some placers have been worked with moderate success. Considerable attention is now being paid to developing the mines. The prospects are that considerable ore will be shipped during the next year from this section.

*Chalk Creek district* lies between Cottonwood and Monarch districts, extending from the Arkansas River to the Gunnison County line. It contains many strong and well-defined veins.

*Monarch district* includes the southern part of Chaffee County. The chief mining camps are Maysville, Monarch, Alpine, and Hancock. Monarch Mountain, in this district, appears to be a vast bed of lead carbonates, located in a heavy lime belt, extending across the range into Tomichi district, and including in its course such well-known mines in Gunnison County as the Legal Tender, Carbonate King, and Eureka.

The best-known property in Monarch district, after the Columbus, is the Madonna Consolidated Mining Company. Its development, which has already exposed an ore-body estimated to be of great extent and value, is composed of a main tunnel 750 feet. Levels have been carried to an aggregate length of 900 feet. The ore varies in value from 5 to 60 ounces silver, and from 40 to 70 per cent. lead. This company began shipping in August, averaging from that time to December 31 50 tons per day.

In a spur of Kangaroo Gulch, near the town of Monarch, is the famous Columbus mine, the property of the New York and Colorado Syndicate Company, on which over 1,200 feet in levels and stopes have been run. An excellent mill on the plan of roasting, stamps, and amalgamation, owned by the same company, is located about a mile from the Columbus mine, with which it is connected by an elevated tramway. The Columbus Mining and Milling Company own, in addition to the Columbus mine, in Chaffee County, the Iron Monitor, Patch, Yale, Last Chance, Erie Placer, and Yellow Dust placer. The properties have not been worked to any considerable extent and produced no bullion.

The Monarch mine, on the mountain which bears its name, was located in July, 1878, and after passing through the hands of several owners, it became the property of the Monarch Mining Company of Connecticut, in 1880. This property has nearly 3,000 feet of development, and the formation of Monarch Mountain can be clearly seen in passing through its workings. There are three distinct contacts in which mineral is found, and in sequent layers of formation, as follows: 1st, lime and quartzite; 2d, quartzite and lime; 3d, lime and quartzite. The formation and association in each are perfect and unbroken, with a dip from southwest to northeast.

The country rock presents three varieties of limestone in succeeding layers, white, blue, and black, the former being of a fine texture, hard, and capable of a high polish. In one place, in the main cross-cut tunnel, there is very fine marble.

The main tunnel has been driven to the length of 300 feet, cross-cutting several leads upon which drifts have been run, and upon which again winzes have been sunk; of this work during the past year 1,500 feet has been done on the crack in the lime above these well-defined contacts before mentioned; 300 feet of running has been done in crossing the formations, with a view of cutting the contact.

Present workings have brought to view one of these caves, the developed area of which is from 6 to 15 feet in width, 15 feet high, and 50 feet long, in the bottom of which is a pay streak, varying in width from 10 inches to 2½ feet, assaying an ore worth $250 per ton. Mineral extracted from the outer formation of lime presents much the same appearance as the mineral in the Dolly Varden and Moose mines of Alma district, Park County. Mill-runs show returns of from $60 to $1,000 per ton, and the management estimates the average figure at $75 per ton, net, which is a very fair and not at all exaggerated estimate.

The mine throughout is in perfect working order, and in every direction gives evidence of careful and intelligent mining. At the mouth of the tunnel is a well-built and convenient house, containing every necessary tool and contrivance for mining uses, with a blacksmith shop and forge and all such facilities as are needful for the working and repairing of iron and the sharpening of tools.

Through the entire length of the main tunnel and drifts are laid tracks, over which the loaded ore-cars are drawn by a burro.

The Fairplay, on Monarch Mountain, a short distance from the Madonna property, was discovered and located in 1878. After passing through a number of ownerships it became, by purchase, the property of its present owner, J. S. Boone, who, in September, 1882, began development. The work done previous to this time consisted mainly of four shafts of a depth of 20 feet each. One of these was sunk to a depth of 73 feet, from which was run a drift of 25 feet, where a body of mineral was struck, carrying from 5 to 30 ounces in silver, a trace of gold, and 45 per cent. in lead. A tunnel of 100 feet was then run into the mountain, upon which was sunk a winze and incline to a depth of 210 feet. In all of these workings good ore was found. A second tunnel has been run in to a length of 290 feet for the purpose of penetrating the ore body at a greater depth. The average returns from shipments has been $53 per ton, net, clear of every expense. The mine in its present capacity can turn out 10 tons of ore per day, and it is expected that when the new tunnel reaches the ore body the output can be doubled. Three shifts are worked in twenty-four hours, eight hours each. The ore, like the other ores of the camp, is free smelting, of the character so much in demand throughout Colorado. This season tracks have been laid in the workings, and all such improvements as are necessary to the proper conduct of a mine have been added. The Fairplay contains one of the largest and most prolific ore bodies in this region, the ore vein in the main drift being from 5 to 10 feet in width.

The Eclipse lode, owned by the Eclipse Mining Company, is a systematically developed property near the Madonna, with a shaft 165 feet and levels and drifts amounting to over 600 feet, disclosing about 3,000 tons of ore, which is blocked and can be extracted very easily. The character of the ore is sand carbonates, galena, and iron carbonates. About 1,000 tons of ore, with an average value of $55 per ton, are in the ore-bins.

The Monticello, the adjoining claim, shows the same character of ore, but, on account of litigation, has not shipped ore during the year.

The Oshkosh has produced about 60 tons of ore, average value 50 ounces silver, 20 per cent. lead. A very small amount only has been shipped. The developments consist of a tunnel 160 feet, shaft 35 feet, and an incline 60 feet, showing a fair amount of mineral.

The Silent Friend, situated just below the Wilson, has 400 feet of development in tunnels and stopes. There are three shafts on this property, the deepest being 85 feet, an incline 150 feet, at the bottom of which is a level 100 feet, disclosing thousands of tons of low-grade lead carbonates. Development work is being pushed, and a large production is expected during the coming year.

The Wilson and Crœsus lodes are being developed in a manner to become producers. About 500 feet of development in drifts, tunnels, and shafts has been done; ore-houses are being erected, and machinery is being put in place. The property has produced only enough during 1883 to pay expenses.

The Charm, owned by the Monarch Pool Mining Company, has been steadily worked and some ore shipped. The ore is similar to that of other mines on Monarch Mountain, except that it is, perhaps, of a little higher grade. The developments consist of a cross-cut tunnel 85 feet, at the end of which a shaft 45 feet was sunk, disclosing a solid floor of galena 3 feet wide and 9 inches of sulphuret ore, the average being 90 ounces in silver and 60 per cent. lead.

The adjoining claim, the Plymouth, which is considered in quantity and richness of ore far superior, is in litigation, hence nothing more than assessment work has been done.

The Merrimack, on the east end of this mountain, near the Black Tiger, has been developed by a 90-foot tunnel on the vein and an incline 165 feet, with a drift 50 feet from the bottom. In the heading of the latter about 12 inches of galena and carbonates have been encountered, assaying 31 ounces silver and 50 per cent. lead.

Below Monarch and up the Middle Fork of the South Arkansas a number of properties have been worked continually, though none of them have thus far shipped any ore, except the Columbus mine, mentioned heretofore. Yet it is not unlikely that that portion of the Monarch district will possess three or four producers during the coming year, the most prominent being the United States Treasury, Lost Treasure, Townsend, Daisy Dean, and Auretta.

The United States Treasury will be cut by a tunnel now being driven through Pomeroy Mountain.

The Lost Treasure will also be opened by a tunnel.

The Townsend is being regularly developed by a shaft of 60 feet, at the bottom of which is a drift 28 feet, showing good mineral.

The Daisy Dean is being worked by a tunnel 110 feet. The showing on the surface is similar to the Columbus, except that the ore is a better grade.

The Auretta has a tunnel 65 feet; at the end of this is a shaft 29 feet, the pay streak, 4½ feet wide, assaying 63 to 87 ounces silver per ton. A lower tunnel, run to cut the vein at a depth of 130 feet, is in 95 feet.

At Emerson Camp, Taylor Gulch, is the Colorado Mountain Chief Consolidated Mining Company's property, consisting of Mountain Chief, Bunker Hill, Denver, Rainbow, Ben Hill, Bonnie Bell, and Zephyr. The ore only averages about $50 per ton; but the immense bodies of ore fully compensate for its low grade. About 1,340 feet of development work has been done in tunnels, drifts, &c. A tunnel 1,100 feet, started in September, will cross-cut the Ben Hill and Bonnie Bell mines at a depth of 600 feet; this is being pushed at a rate of 100 feet a month.

*Cottonwood district*—The information in regard to this district has been very kindly furnished by Mr. J. K. Vanatta, of Buena Vista, Chaffee County. This district is situated about the center of the county, and runs from the Arkansas River on the eastern boundary to the Continental divide on the western boundary of the county. This district has been subdivided into North, Middle, and South Cottonwood districts.

Buena Vista, situated on main Cottonwood Creek and below the junction of the two branches, is the natural supply point for all of the district as well as for the Texas Creek mines, which are just across the range from the head of the North Cottonwood Creek. This district is unfortunate in being situated between two other districts in both of which mineral was discovered prior—Clear Creek district on the north and Chalk Creek district on the south; the excitement created by the discoveries in these two districts, as a matter of course drew prospectors and capital into them, and practically left this district to develop itself. Some few staid by their prospects, and nearly all of those who did are now reaping the reward for their labors. Some have located a large number of claims, but have no time to develop any one of them, as it takes about one-half of their time to raise a "grub stake" to live on while doing the annual assessment on their claims.

North Cottonwood has many good prospects, and several which will produce this coming season.

At the head of the creek is the Gray Eagle lode, owned by Pearce & Grabill, which shows a well-defined lead containing galena. There was about 14 feet of work done on this lode this season, and if worked to any depth no doubt but it would become a good producer; some of the ore taken out at a depth of 14 feet assayed 35 ounces silver and 23 per cent. lead.

But a short distance from the Gray Eagle, but upon a different lode, we have the Fannie Wyatt lode, which was located in 1883. It is developed by one shaft 70 feet, another 18 feet, and another 10 feet deep, all of which show a good class of mineral. In the main shaft at 40 feet from the surface is a level 14 feet showing a 4-foot vein of solid mineral. At the bottom of this same shaft is another level, 30 feet, with a drift in two directions at right angles with the level, each about 18 feet. The ore on this level is the same as that above, carrying from 50 to 60 ounces of silver and 10 per cent. copper. The ore-houses of this property contain about $2,000 of sacked ore, and the dump is estimated at $6,000. The ore is pyrites of copper and galena, and is worth on an average $100 per ton at the mine. The wagon-road is completed to within a short distance of the mine, and next year the claim will be set down upon the list of producers. It is owned by the Clarence Mining Company of Topeka, Kans.

The Queen Bee lode was located in this district in June of this year, since which time about 140 feet of development work has been done. A tunnel has been run on the lead for over 100 feet, and tunnel-house and living houses erected. The ore is a lead carbonate, with about 11 per cent. copper; some assays show as high as 300 ounces of silver to the ton, but mill-runs show the ore to be worth about $125 per ton on the dump. Ore is being taken out and sacked ready for shipment as soon as the snow will permit. This lode is owned by Anglemyer, Vanatta & Wade, and as soon as the snow will permit will produce plenty of good ore. The vein on this property is about 9 feet wide, and the pay streak is about 33 inches, the best ore being found near the hanging wall.

The Hidden Treasure lode, near the Queen Bee, is good property, but very little work has been done the past year.

The Buena Vista lode, owned by Thompson & Johnston, is on the east side of the creek, and is showing well as the work progresses. The tunnel is in about 95 feet, and they are pushing work as fast as the winter and their means will permit.

On the Middle Cottonwood the only mine of any importance is the Gladstone. The vein is from 6 to 7 feet wide, and very nearly all pay ore. The ore from this mine nets the owners about $100 per ton. It has about 700 feet of development work, shafts, cross-cuts, and winzes. This last summer the water impeded progress so much that the owners concluded to run a tunnel from the bottom of the hill, a distance of 1,600 feet, which will cut the lead at a depth of about 1,100 feet. They have an Ingersoll drill and engine, and are now prosecuting the work. This tunnel is now about 500 feet in, and they expect to finish by August 1, 1884, when the mine will come to the front and pay a good round dividend.

There are a large number of locations made around the Gladstone, none of which have as yet given very strong promises, but the owners are working steadily and the prospects are that some of them will find the Gladstone lead.

On Sheep Mountain, at the junction of Middle and South Cottonwood, are the Lottie and Martha Bonny lodes, both having a well-defined vein, and would become paying mines with very little work if the owners would work the property.

On Mount Carmel is situated the Mount Carmel lode, having a well-defined lead 30 feet wide, with solid walls on both sides. Over 300 feet of development work has been done on this property. The ore will average $50 per ton, but picked pieces run very high. There has been very little work done on this property this year. Parties in Philadelphia have a bond on the mine for $50,000.

There are as many as one hundred locations in this gulch that show ore running from 35 ounces to 300 ounces in silver per ton, but the main part of them are owned by a few who cannot do more than the annual assessment each year, and then quietly wait for some one to buy them out.

The Cora Bell, Gray Copper, Green Copper, and Charlie D. lodes are all good properties, and only need development to become producers.

On Jones Mountain, at the head of South Cottonwood, the El Dorado Company have some good property, consisting of the El Dorado, Little Missouria, Amanda, and Fraction lodes, each of which has a well-defined vein, carrying about 80 ounces silver and from 40 to 60 ounces lead. This property has about 260 feet of development work on it, and the company is prepared to go into active operation next spring.

In Maxwell Gulch are the Guthrie and Little Cuba lodes, each of which show some good ore, assaying from $100 to $125.

The Little Cuba has an incline on the vein about 53 feet, and shows a well-defined vein.

A large amount of work is being done on Mount Princeton in this district.

The Cornucopia Mining Company have commenced a tunnel to cut the leads in their property, and have an Ingersoll drill at work now, and are pushing the work as fast as it could be done, running regular shifts.

The Dandy mine is not working this winter, but the stockholders have too good a thing in this mine to let it go, and will commence active operations in the spring. This mine has showed mineral assaying as high as $6,000 per ton.

The Sharpe and Fleetwood Tunnel Company have a group of locations on this mountain which bid fair to become good property, with development.

The Hortense Mining Company have also a good property on the southern spur of this mountain, upon which a large amount of money has been expended; one cross-cut tunnel, 700 feet, which brings the ore out on their wagon-road. This mine is now leased, and the lessees are shipping several tons of ore per day.

The Lily White Milling and Mining Company also have some very good prospects on this mountain, but as yet have shown nothing of much importance.

There are hundreds of locations in this district which are not mentioned herein for the reason that the owners do only assessment work on them.

From all I can learn of the output of this district there has been about $65,000 worth of ore shipped out of this district during 1883.

Clear Creek district has not fulfilled the promises indicated a year ago. The output for the year hardly measures the value of the district, for the reason that some of its best properties have been idle most of the time on account of disagreement among the owners or of litigation. The output of this district will not exceed 100 tons, with a value of not over $5,000 in silver and probably $3,000 in the base metals. Except in a few cases a very limited amount of development has been done and the future is anything but promising.

The Swiss Boy, on Mount Hope, which is perhaps the most important property in the district, has been worked but little and the shipments were small. The working consists of an incline 110 feet; at 60 feet levels were run each way to connect with shafts. The pay streak is about 18 inches, carrying native and wire silver, gray copper, and galena.

In Black Bear Gulch is the Baracouta, the first mine in this locality that created any excitement. This property has been systematically worked; the ore-bodies not touched, and the shipments have consisted of ore taken out in development. The vein is 15 feet wide, with pay streak of 16 inches. There is, moreover, 5½ feet of scattered mineral that will be concentrated. The ore carrying galena and pyrites of copper is low grade, 35 ounces silver per ton.

The Kangaroo, an extension of the Baracouta, has a vein 18 feet, with pay streak 16 inches, and a concentrating ore streak 6 feet. The ore is of higher grade than the Baracouta, averaging 42 ounces of silver per ton. The developments consist of an incline on the vein 48 feet. Some ore was shipped during the summer.

The Ballarat is an extension of the Kangaroo, having the same character of mineral. Only assessment work has been done on this claim.

The Rosa Wells lode, near the Baracouta, shows a vein 4 feet in width, with the same character of ore found in that mine. A cross-cut tunnel is being driven to cut the vein at 100 feet. The tunnel is now 150 feet, with 30 more feet to strike the vein.

In *Hope district* mining is done on a small scale, except by the Twin Lakes Hydraulic Gold Mining Syndicate of London, whose efforts are being rewarded in a manner to make others turn their attention and capital to this region. This company own about 7,000 acres of placer ground between Granite and Twin Lakes, and embrace the well-known claims along Cashe, Clear Creek, and Young America Creeks.

The Cashe Creek property, formerly owned by the Gaff Mining Company, is the most developed, having been worked continually for the past fifteen years. The auriferous pay gravel on these claims has a thickness of from 12 to 100 feet. There have been about two miles of Cashe Creek opened in the center of the channel; a total area of about fifty acres. The company are building a ditch 4½ miles long, which will bring in 2,500 inches of water. Over 10,000 feet of this is now finished; also about 16,000 feet of fluming. A tunnel has been driven 600 feet, and is advancing as rapidly as possible, and will be completed in season for work in the spring, when the flume will be set on the grade and the property worked to its full extent.

Quite a number of lodes will begin producing the next year, and considerable development is being done this winter.

The Jennett lode shipped some ore in 1883, and has quite a large dump that will be shipped during the spring; the vein, 20 inches wide, has a streak of quartz carrying 2½ ounces gold per ton and contains scattered galena that runs 23 ounces silver. The developments consist of a 50-foot shaft, a cross-cut, 160 feet, that strikes the vein at 175 feet in depth.

Along the Arkansas River and creeks in this district about $2,000 was produced by rockers and by panning; the men so working have made good wages thereby.

*Chalk Creek district* contains many well-developed mines, and is capable of producing more bullion than can be given to its credit this year. It is not unlikely, however, that the coming season will witness more activity than has been seen in any previous year. The Murphy, Tressie C., Mollie, Pioneer, Quincy, Big Bonanza, Gold Field, Stanley, Iron Chest, Lone Star, and a host of others have ore-reserves in sight in satisfactory quantities waiting either for some process that can successfully reduce the ores or for cheaper transportation.

The amount paid out monthly during the past year for extracting and smelting ores will give some idea of what may be expected of Saint Elmo in the future, viz:

| | |
|---|---|
| *The Murphy Company | $3,700 |
| Tressie C | 3,300 |
| Livingston | 1,200 |
| Brittensteno | 700 |
| Northern Boy | 600 |
| Chrysolite | 600 |
| Big Bonanza | 550 |
| Sierra Nevada | 500 |
| Gold Field | 300 |

The grand total of these payments monthly is $11,450, besides what is paid out by individuals, which will swell the amount to more than $15,000.

The other localities in the district are showing signs of life and more property is being worked and a better feeling prevails than at any previous time for the past four years.

On Murphy Mountain is the property of the Murphy Mining Company, the Mary Murphy and Pat Murphy claims. These mines are the best developed and largest producers in the district. The two veins are parallel, extending down the north and south slopes of the mountain.

On the Mary Murphy claim, the discovery shaft on the summit of the hill, is sunk to a winze, 100 feet from which levels have been run about 600 feet. Level No. 3, 80 feet vertically lower than level No. 2, has about 700 feet of development, the vein widening from 5 feet between walls on the second level to 8 feet on this. On this level two winzes were sunk 80 feet vertically below to level No. 4, passing through rich ore that has been extracted during the year. Level No. 4 has an aggregate length of 485 feet, the ore-body widening to 12½ feet. This level was pushed through 158 feet of slide to reach the vein, and the ore-bodies in the level remained untouched until August, when large quantities of ore were extracted, the average value being about $100 per ton. A tunnel now being run to cut the vein at the depth of 2,100 feet is progressing rapidly. A tramway carries the ore from near the mouth of level No. 4 to the railroad, almost a mile distant, its capacity being about 125 tons per day.

The Pat Murphy is being developed by three levels being run on the vein; level No. 1 being about 100 feet below the crest of the hill, level No. 2 100 feet below this, and level No. 3 about 90 feet below level No. 2. Level No. 1 is 160 feet in length, disclosing a 5-foot vein of mineral averaging $70 per ton. Level No. 2 has been driven 285 feet, showing 13 feet between walls, averaging $90 per ton. Level No. 3 was recently started, the contract calling for 500 feet. In cutting the chamber to start the winze in this level a rich body of quartz was found, the pay streak being nearly 4 feet wide; the average value in gold and silver being $100 per ton.

Below the Murphy, on the same slope of the mountain to the south, is the Livingstone, which has an aggregate of 900 feet of development in 4 levels and a shaft 275 feet. The mineral is of the same character, and the width of vein about the same as the Murphy.

The Pioneer, the first extension north of the Mary Murphy, is working through a tunnel 130 feet. The vein filling is about the same as the Murphy.

The Mollie, north of the Pioneer, has croppings that are free milling, with value from 4 to 13 ounces gold and 30 to 65 ounces silver per ton. The width of vein is nearly 100 feet between walls. A very small amount of ore has been shipped from this property.

The Iron Chest, an extension of the Pat Murphy vein, has a tunnel 300 feet in length along the vein upon a pay streak from three to five feet in thickness. Little had been done with this property during the year until the present lessee took hold and sunk a shaft 135 feet. At this depth a drift was run on the vein that disclosed a solid ledge of ore 18 inches wide, 9 inches of which is rich in gold and silver. While the flesh-colored rock of the Murphy belt was present, the blue mineral similar to the rich gold ore of the Tressie C., with yellow copper thickly interspersed, predominates. Sinking and drifting will be continued during the winter. The spring will probably find this property one of the largest producers in Chalk Creek.

West of the Murphy, and parallel, is the Tressie C. An incline 170 feet was run connecting with a shaft at a depth of 50 feet from the surface. The rich bodies of ore exposed in this property have encouraged the owners, who let a contract for 200 feet of development, as follows: Lower north drift, 50 feet; upper south drift, 50 feet; lower south drift, 50 feet; and main tunnel, 50 feet. The present levels consist of an upper south drift 30 feet, showing 2-foot body of gold bearing ore; upper north drift, 35 feet; the lower north drift, 43 feet, and lower south drift, 18 feet. On the lower south drift 15 feet will cut the ore body shown in the upper south drift. The upper drifts are at the 25-foot level and the lower drifts 50 feet below. The vein filling is gray copper, galena and copper pyrites, the copper pyrites being similar to the rich gold-bearing ore found in the Bassick mine at Rosita. The gray copper is found in bowlders, which are in fact a mixture of copper, silver, and antimony. When quartz appears it has a dull pink or flesh-colored appearance, which is characteristic of the best ore of the Mary Murphy. The ore is worth about $500 per ton, a few car-loads only having been shipped during 1883, the balance being stored in the ore houses.

On the west side of Chrysolite Mountain is the Northern Boy claim, the property of the Early Silver Mining Company. A tunnel was run a distance of 43 feet, at the end of which a drift run to the south disclosed an ore-body from 1 to 5 feet of solid carbonate of iron with value of $40 per ton. The company are drifting both north and south, extracting the ore. The tunnel will be run 50 more feet, where the main vein is supposed to be. This ore is different from any yet found on this mountain, and the excellent average grade will be an inducement for the company to thoroughly develop the property.

The southern extension of the Northern Boy is Gold Field, the pay streak of which is 6 inches, composed of a quartz running from 220 to 350 ounces of silver per ton; in addition to this there is about 2 feet of ore which is of low grade, but sufficiently rich to pay a handsome profit. This property is developed by a shaft 50 feet, with probably 75 feet of drifts.

The Big Ella, near the Northern Boy, was intersected by a cross-cut tunnel that showed a vein of 18 feet of mineralized quartz.

The Cuckoo, 500 feet below the Northern Boy, at a depth of 25 feet shows the same kind of mineral as that property. A contract to sink 100 feet on the vein has been awarded.

On the Grizzly Gulch slope of Chrysolite Mountain are two claims, probably the oldest locations in the district, the Evening Star and Decorah. The veins are parallel on the Murphy belt, and have as fine a surface showing as any in the district.

The Chrysolite tunnel, that opens in this gulch, has again resumed operations. The tunnel, which is 1,017 feet, will, in its course, cut a dozen strong and valuable mineral veins, including Quincy and Murphy and others less valuable. This property is owned by the Saint Elmo Mining and Milling Company, of Missouri.

On the same side of the mountain, but further to the south, is the Brittenstene Mining Company's property, the Lily, Virginia, and Quincy mines. On the former shafts are being sunk from the tunnel level 100 feet, and a contract has been let to sink the Quincy shaft, now down 120 feet, 50 feet further. The property is now in good shape for producing.

Further to the south is the property of the Luke Vein Mining and Tunnel Company, which is under a process of development, which consists of a cross-cut tunnel now in 750 feet, having cut the Minnehaha vein, disclosing 20 inches of solid mineral.

On Pomeroy Mountain the best developed properties are the Stanley

Group, Big Bonanza, Little Bonanza, Rarus and Warrior, Lone Star Group, Flora Bell, and the Pomeroy Group.

The Stanley property embraces five claims, viz, the Stanley, Humboldt, Tom Ewing, Ben Butler, and Ben Franklin.

On the Stanley the tunnel is now in 500 feet. Having failed to disclose any ore-body, a cross-cut is now being run. A shaft of 55 feet sunk on the vein some 900 feet from the tunnel opening, has disclosed 2 feet of high-grade ore. In this vein is found the same character of ore that has attracted so much attention in the Murphy.

On the other claims of the Stanley Group nothing beyond the assessment work has been done.

The Little Bonanza, to the west of the Stanley, has been opened during the year sufficiently to become a producer. An incline shaft was sunk on the vein 72 feet, and a tunnel was driven 120 feet; the vein between walls is 5 feet with mineral streak of 20 inches. The ore will average $60 per ton, a very small amount having been shipped, the balance, about 50 tons, remains in the ore-house.

The Big Bonanza, the western extention of the Little Bonanza, is being developed by a tunnel that has disclosed a pay streak in the vein 18 inches, that average $50 per ton in value.

The Rarus and Warrior, located at the bottom of the hill near the town of Hancock, is owned by the Rarus and Warrior Consolidated Mining Company. These are extensions one of the other on the same vein. The development work consists of a tunnel 100 feet in length on the vein, and an incline at the end of the tunnel sunk 90 feet on the vein; a cross-cut at the bottom of the incline of 20 feet was made to cut the walls of the vein, which it failed to do. The mineral throughout is continuous and varies in width from 6 inches to 3 feet, averaging in value 50 ounces silver and a trace of gold.

Further up the mountain is the Lone Star Group, consisting of the Lone Star, Big Casino, and Little Casino, the property of the Lone Star Mining Company of Kansas. The principal development has been done in a shaft now about 95 deep on the Lone Star vein. In this shaft is a fine showing of high-grade ore, the pay streak widening from 9 inches near the surface to 21 inches at bottom of shaft. An excess of water prevented this property from being worked, and the company have ordered an engine and pumps to be placed so that development may be continued in the spring.

Nearly west of the Lone Star is the Flora Bell mine. The mineral streak is about 17 inches wide, carrying copper, lead sulphurets, native silver, and silver glance. In sinking the shaft 87 feet 15 tons of ore was extracted, worth about $60 per ton. The vein will be explored during the coming season.

On the Pomeroy Group very little has been done. The property, which consists of the Mineral Point, Lily, Big Smoke, and Goldstone veins, might be worked to an advantage, and be made to pay handsomely. The developments consist of 195-foot tunnel on the Mineral Point vein, which shows a pay streak from 6 to 14 inches wide. The Lily shows at the bottom of the shaft, which is 80 feet, a pay streak 30 inches, galena and gray copper carrying about one-half ounce gold and 90 ounces silver per ton.

On Mineral Ridge are found the Kentucky and Stonewall.

The Kentucky has a vein 35 feet between walls, having four distinct mineral-bearing streaks, the first, which is 10 feet from the foot-wall, is 10 to 12 inches of galena, and quartz from 5 to 7 feet thick; 2 feet beyond this is another streak of galena 18 to 24 inches wide. The ore is low grade, averaging from 12 to 20 ounces silver. The developments consist of a shaft 115 feet, with probably 60 feet of drifts.

The Stonewall is developed by a main shaft 350 feet deep, with drifts run at every 50 feet both ways from the shaft, aggregating 500 feet; the mineral is low grade, ranging from 10 to 20 ounces silver, and from 50 to 66 per cent. lead, making it a very desirable smelting ore. The vein is about 30 feet wide, the pay streak averaging 30 inches. This property has been equipped with excellent machinery.

Very little has been done with other properties on this mountain, although many of them possess good veins and could be made to produce; most notable of which are the Patten, Miller, Tickler, and the claims of the Diamond Queen Mining Company.

In Baldwin Gulch the Sitting Bull mine has made but little progress; the tunnel is now about 190 feet, showing in a spur vein 2 feet wide of mineral that averages $40 per ton.

On Mammac Mountain are the Silver Queen and Schuyler Group; on Sugar-Loaf Mountain the Clinton and Jennie, properties that show good mineral and possess sufficient development to encourage the owners to resume operations, but during the past year very little progress was made towards making them paying mines.

I have estimated the production of this county for the year 1883 to have been: Gold, $50,000; silver, $265,000; total, $315,000.

This is a slight increase in gold and a large increase in silver over 1882, a net increase of $170,000.

### CLEAR CREEK COUNTY.

Clear Creek County includes the region drained by South Clear Creek, bounded on the north by Gilpin County, on the east by Jefferson, south by Park, and west by Grand and Summit. This county is a network of fissure veins, and while far in advance of almost any other portion of the State in the development of its mines, many miners think that it is still in a primitive running state, and that the full richness of its veins are yet to be disclosed. This county is divided into two mining districts, one embracing the silver-bearing veins in the vicinity of Georgetown, the other the copper and iron veins in the vicinity of Idaho Springs. Gold was discovered on Chicago Creek and Spanish Bar in 1859. The gold lodes and placers at Empire produced considerably from 1862 to 1864. In 1856 silver was first discovered on McClellan Mountain. This discovery produced little or no excitement, there being no means to reduce the ore, and it was not until 1869–'70 and '71 that the miners forsook their placers and gold lodes at Empire and Idaho Springs to open the great fissures of McClellan, Leavenworth, Republican, Democrat, and Sherman Mountains. For many years lodes near Georgetown and Idaho were worked for gold, while their main value consisted in silver, but after the smelters were started gold mining began to decline and the silver to increase largely. Those especially prominent in the earlier years of silver mining were the Equator, Terrible, Brown, Coin, Compass and Square, Anglo Saxon, Astor, Belmont, and International. Within the year 1883 the vicinity of Idaho Springs has shown encouraging signs for placer mining of free-gold milling ore.

*Argentine district*, embracing the northwestern portion of the county, contains some of the best developed properties in Colorado. Six miles northeast of Georgetown, and about 8 miles from Idaho Springs, is Red Elephant Mountain, rising abruptly on the north side of South Clear Creek Valley. The largest producer here is the Red Elephant Mining

Company, which consists of the White, two claims, aggregating 3,000 feet, Boulder Nest, 1,500 feet, and the Free American, 1,500 feet. This property, since it adopted the system of leasing, has paid a large indebtedness in addition to large dividends. The veins have only been worked since 1877, yet the amount of development and stoping already done might well be compared with mines in Mexico and the Hartz Mountain mines, which have been worked for years.

The Disbro workings on the extension of the White are filled up with water, having been shut down for two or three years. A large body of high-grade mineral is known to exist in these workings, and consequently the lessees are busily engaged driving a cross-cut tunnel to intersect and drain them. It is run from the Homestake lode, and is now 250 feet in length. They expect to intersect the vein momentarily. When completed it will give access to 1,200 feet of the whole lode that heretofore they have not been able to work.

The Cleary adit is run west on the lode 1,200 feet, and cuts the Boulder Nest and Free American at a depth of 450 feet, Nearly all the White lode proper has been worked out. For the past two years or more work has been confined to the hanging and foot walls, which have produced quite as much wealth as the main vein itself.

Above the adit, on the hanging wall, are four parties of lessees. They are drifting on the streak with very encouraging results.

Some feet in the hanging wall is Gates & Longacre's lease, which is in big pay. The handsome sum of $20,000 was taken from a small block of this ground.

Immediately east, and adjoining, Clancy, Bean & Co. continue to take out fine mineral, which they have been doing for the past ten months. The pay streak here varies in thickness from 2 to 12 inches, and mills from 100 to 250 ounces silver per ton. It is galena and gray copper.

Messrs. Van Sickle & Gordon, who are stoping above the Longacre lease, have struck a large and rich pocket of ore of the same character and quality as that mentioned above.

About 100 feet above these workings Hanly & White are taking out rich ore.

In the Hogan workings a force of miners are drifting on the pay streak, which varies from 6 to 12 inches of solid ore. The mill-runs return from 100 to 300 ounces per ton.

Whit. Malcom is drifting on the third level west of the main shaft on the White, with good results. This is all that is being done at present above the Cleary adit.

Considerable work is being done on the levels run from the main shaft. This shaft, commonly called the Schwarz, has attained a depth of 480 feet. In the bottom there is an excellent body of mineral, but at present this will be left undisturbed. In the 60-foot level below the adit, John Brocky & Co. are drifting west, and have flattering showing. On the next level, 50 feet below, Nash & Co. are stoping on high-grade ore 2 to 4 inches thick. This is the sixth level of the White and connects with the eighth level of the Boulder Nest. On the hanging wall on the level is the Syster streak, showing scattered mineral from 4 to 14 inches in width. The entire crevice will mill 100 ounces per ton. Between this and the White veins another party is drifting on 3 inches of 300-ounce ore. In the west drift on this level, at the junction with the Boulder Nest lode, Lanhan & Co. have started drifting on the foot-wall streak. The drift has already produced a large amount of money. The seventh evel is worked by Buchanan & Co., who are drifting east and west from he main shaft. There is 5 inches of pay mineral in the east, while the stopes west disclose from 14 to 16 inches, and the west drift, running to intersect the Boulder Nest, enjoys from 4 to 10 inches. The ore mills 75 to 100 ounces silver per ton.

Boulder Nest.—The main shaft is 520 feet deep. White & Co. are stoping on the third level east with marked success. The pay streak ranges from 6 to 12 inches. The last mill run returned from 50 to 125 ounces per ton. On the seventh level, near the junction of the White and Boulder Nest, Syster Brothers have started a drift running west on the foot-wall. At present there is a large body of low-grade ore. It is the intention to push this drift rapidly ahead until the high-grade ore known to exist is cut. The Bush Willis shaft has been cleaned out, and Roberts & Co. are now drifting 100 feet west of it on pay ore. From this shaft some of the richest mineral ever taken out was found.

The Free American.—No new work is in progress here. Five parties of lessees, numbering 12 men in all, are mining in different places and average more than wages per man. The shaft, which was caved for 60 feet down by the heavy rains, has been about cleaned again and put in good shape for working.

The Free American Extension embraces 1,500 feet on the same vein as the Free American, immediately east of the Red Elephant property.

The Shenandoah Valley is worked by an adit, just below the Free American. William Dulaney and Golden parties own it. Over 700 feet of drifting has been done on the vein, with some sinking. An 8-inch streak of 500-ounce ore was struck some months ago. Development is now being done under contract.

Across the gulch is Columbia Mountain, on which are the Murray, Columbian, Chief, and Koohinoor, and the Joe Reynolds Group.

The Murray, opposite Lawson, is being worked by lessees, the outlet being through the main shaft, 280 feet deep. The engine shaft is used to develop the lower workings of the Columbian Chief mine. The levels aggregate about 1,500 feet.

The Columbian Chief adjoins the Murray; the deepest workings are at 300 feet, the aggregate in levels is 450 feet. It is being worked through the 180-foot level in the Murray mine. The pay streak ranges from 4 to 8 inches of galena gray copper and copper pyrites that mills 250 ounces silver per ton.

The Multum in Parvo, about 1,000 feet above the Murray, is being worked by a drift on the vein of 160 feet in length. At 120 feet a shaft was sunk 60 feet deep disclosing a vein of 6 inches of ore all the way down that mills 250 ounces silver per ton.

The Kohinoor lode of the Kohinoor and Donaldson Mining Company, on the lower end of this mountain, is opened by shafts, tunnels, and levels that aggregate almost 1,500 feet. The deepest workings are nearly 400 feet. At present the company is shipping 8 to 10 tons of ore a day. The product nets from $10 to $100 per ton. The sand ore averages about 15 ounces of silver to the ton and contains 40 per cent. lead. A considerable amount of galena ore is also obtained, ranging from 100 to 150 ounces in silver and 70 per cent. in lead. The mine shows quite extensive resources.

The Joe Reynolds group consists of four claims, three of which are worked by lessees. This property was practically abandoned two years ago, when James Dailey, the present superintendent, in running a cross-cut in the Dailey level disclosed a 20-inch streak of rich mineral, since which time many cross-cuts have been made, all disclosing this streak of ore. On the Joe Reynolds No. 1 the developments consist of a shaft 240 feet, and a level 250 feet. Joe Reynolds No. 2 has a shaft 110 feet and a level 450 feet. Joe Reynolds No. 3 has three levels, and is the best developed of the group. It is reached by a cross cut some 200 feet long, from which the lowest or O'Connel level has been driven over 900 feet on the vein. Sixty-three feet above is the Dailey level, 700 feet long; 47 feet higher up the Discovery level has been run 500 feet, while 180 feet above that again is the old Cartwright level, 63 feet long. In the O'Connel level, 640 feet from the mouth of the cross-cut, the Abeel cross-cut was started, which has already crossed No. 1 and No. 2 lodes and has 60 feet to run before cutting No. 4. These lodes are all struck some 500 feet deep. and the levels run upon them constantly gain depth. There is enough ground opened up to furnish thirty years of continuous stoping to as many men as can be advantageously put to work. The old ground hitherto abandoned as worthless is now yielding, under the system of cross-cutting before alluded to, the most and the best mineral. Among the returns of ore shipments may be mentioned a 2½-ton lot from No. 1 that ran 240 ounces silver per ton. From the same lode, Dailey level, 3 men, working twenty-six days, took out 2¾ tons, which brought them, above mill charges, $241.88, the first class running 213 ounces silver and one-tenth of an ounce gold; second class, 78 ounces silver. One man working twenty-three days in No. 1, O'Connel level, west of the Abeel cross-cut, mined 2 tons, which ran 328 ounces first class, 168 second, the lot netting $367.96. West of the 110-foot shaft on No. 2 lode, 2 men in twenty days got out 2½ tons, which, in three classes, gave 222, 155, and 68 ounces, respectively, with a net return of $387.99.

Empire is located on the northern branch of South Clear Creek, about 2 miles above where the stream forks, and was built up by the gold diggings on Silver and Colorado Mountains in 1862–'63. Sluicing and stamp-milling were extensively carried on in those days, and a lively camp was the result. After years of depression Empire is again the theater of extensive mining operations.

The Empire City lode has come to the front as a gold-producer. It belongs to W. M. Moore, H. H. Suttle, and Mr. J. W. Summers, of Keokuk, Iowa. It is situated on Covode Mountain, at the north edge of town, and only a few steps from Mr. Moore's back door. Like all the other lodes in Empire, it produced rich surface quartz, and yielded rich returns till the fatal "black cap" was struck, which blighted the whole district so fatally that only now, after years of disappointment, has the camp begun to look up again. There are three levels driven northeasterly on the vein; the upper one is 65 feet in, the middle one 45 feet, and the third or lowest, through which all the workings are now conducted, 202 feet in, with the breast 200 feet deep. An air-shaft from about the middle of the lower level rises 55 feet to surface. This main or lower level now has 200 feet of stoping-ground opened up and timbered, and work is being actively pushed there. The pay streak averages from 4 inches to 1 foot solid auriferous quartz and iron, besides about 2 to 3 feet of mill-dirt on the sides. Thirteen tons of the mill-dirt were recently run through the new Atlas mill at Empire station. The free gold saved on the copper plates realized at the Denver mint $90.98. Besides this there were 7 tons of concentrates, running $17.22 per ton.

The Cashier is another property that has come to the front this year. When the present lessees, Messrs. Swanson & Johnson, took a lease on the property they found a 35-foot shaft and a drift 30 feet northeast on the vein, which runs up the mountain from the Empire station road. Beginning 50 feet lower down they drifted 100 feet in, raised to the shaft, and continued ahead on the new level 65 feet farther, all the way on a vein of solid ore from 18 inches to 5 feet wide. They also cross-cut west some distance beyond the raise and struck 5 feet of the same solid ore, upon which they drifted about 50 feet northeast and raised a small stope. About 130 feet in on the lower level is 15 inches of honey-comb quartz carrying free gold on the east side, and an unknown thickness of concentrating ore on the west, through which they had not yet cross-cut.

The Windsor, on Covode Mountain, near the Empire City lode, is looking exceedingly well. A new and important strike was lately made in the face of the 80-foot tunnel. The vein measures from 10 to 12 inches and mills 2½ ounces gold per ton. First class, 3.7 ounces gold and 10 ounces silver per ton; second class, 2.7 ounces gold, 6 ounces silver per ton. This property is being worked steadily with two shifts of miners. The character of the mineral is iron and copper pyrites. Besides the regular streak there is about 18 inches of free-milling ore that runs $13 per ton. This property is owned and worked by S. M. Cowles.

The Snowy Range lode is at present under a course of development. A drift run on the vein shows an 8-inch streak of mineral that assays from 150 to 3,000 ounces silver per ton.

Democrat Mountain, overlooking the lower part of Georgetown, has yielded a vast amount of bullion. The most prominent mines at present are the Matilda Fletcher, Fred Rogers, Astor, Little Emma, of the Good Luck Mining and Milling Company, Polar Star, the Wolverine Group, Lucky Hesperus, and Cliff mines. The Bonanza tunnel, on the west side of the mountain, has cut the Jordan lode, which is producing, and the Moline tunnel has cut the new Boston lode, and that is also yielding largely.

Matilda Fletcher is developed by levels and shafts, &c., in all over 2,700 feet. There are at present ten men at work upon the property, which is producing steadily a splendid grade of ore, running from 200 ounces silver upwards, carrying on an average 25 per cent. lead. In the mineral can be found ruby and native silver and gray copper. It is owned by the Fletcher Gold and Silver Mining Company.

Fred Rogers and Government.—The engine shaft is 380 feet deep, from which are five levels, partly on the Fred Rogers and Government. The first level is 200 feet long, the second 200 feet, the third 250 feet, the fourth 375 feet, and the fifth 600 feet. There is a cross-cut of about 100 feet which intersects the property, upon which are something like 400 feet of drifting. These mines have produced over $280,000. They are being worked by a strong force and are steadily producing. The first-class ore runs about 1,000 ounces silver, the second 400, and the third 100. The Lincoln Mining Company and Duncan McArthur are the owners.

The Astor is developed by a tunnel 500 feet, which cuts the vein at a depth of 200 feet from the surface. A drift 75 feet leads to a stope 174 feet in length, disclosing a continuous streak of ore from 10 to 15 inches in thickness. West of the 75-foot drift is a shaft 60 feet, at the bottom of which is seen the same streak of ore seen in the stope above. The ore that runs 1,080 ounces silver in first class and 350 in second class is left blocked out. No ore except that extracted in development has been shipped.

The Little Emma.—The Matthews tunnel connected with the main shaft about April 1, at a depth of 440 feet below the present working tunnel level, and about 640 feet below the summit of Democrat Mountain. The Matthews tunnel is 1,250 feet long where it connects by an

80-foot winze with the sixth level, which latter connects 200 feet farther east with the main shaft now down 360 feet below the working tunnel level. Seven men are working on a single day shift, principally in the fifth level, which is now about 120 feet west of the main shaft. This will be continued 80 feet so as to connect with the 80-foot winze from the sixth level to the Matthews tunnel. This same connection will be made with all the levels, when rock and ore can all be shipped by gravity from 440 to 640 feet, thus saving an immense sum for hoisting. In fact all the machinery in the present tunnel level will be removed in time to the Matthews tunnel. There is an inch streak of ore in the fifth level all the way west from the shaft, which mill-runs 600 ounces in one class. Ore has been taken out of every level as far as run. The Matthews tunnel is run all the way on the lode, and cost an average of $6.50 per foot to run it. The whole property, with the Little Emma Extension and the Emma, all patented claims, is owned by the Good Luck Mining and Milling Company.

Polar Star has levels to the number of 2,500 feet, and shafts 600 feet. It has produced $125,000. Last November Major Fulton took hold of this property, and has opened new ground and otherwise developed it. There is one engine in running order, and another about to be put up at a distance of 800 feet. Twelve men are at work, and as ground is opened it is the intention to increase the force. Work at present consists of stoping west of the shaft, with about 4 feet of quartz, with mineral scattered throughout. On one side of the lode is a soft gouge, developing rich mineral in bunches from 1 to 3 inches wide, carrying gray and yellow copper with silver glance.

The Wolverine Group.—This group of lodes, situated on Democrat Mountain, consists of the following: The Wolverine, Swamp, Gouge, Oscar Wilde, S. S. Horton, Augusta, and Buckeye.

The Wolverine has a drift run on the vein 415 feet, which shows all the way, and at the breast a large block of ground is being stoped out, and good mineral in sight, the ore being sprinkled with silver glance.

The Swamp has a tunnel 130 feet in length, and is under lease to M. A. Clark and C. G. Sutton. They are taking out some fine ore, which mills 990 ounces silver per ton. Work is being done on the surface of this group with good results, and, without a doubt, this property will in time, as developments increase, become among the best producers.

Lucky Hesperus is developed by 560 feet of shafts, 450 feet of levels, two cross-cut tunnels 125 and 180 feet long, and an adit level 120 feet in length. The first-class ore runs 450 ounces, second-class 180 ounces, and third-class 80 ounces. Within the side lines are three distinct mineral-bearing veins, varying from 12 to 20 feet in width. This mine has produced to date some $260,000.

The Clift lode.—The Clift lode, on the easterly slope of Democrat Mountain, has now run upon it about 1,400 feet of levels, all of which have been driven in the very best mine fashion, and will compare favorably with any work done in the State. The timbering especially cannot be excelled. The upper level is now about 200 feet, and is being pushed steadily ahead by McCann Brothers & Hall, lessees. They have also commenced stoping, and have some mineral in both stope and drift. It is somewhat scattered, however, though the lessees expect it to come in big with a little more development. The middle level, which is between 600 and 700 feet, is being worked by Bazzel & Co., who are stoping altogether, driving ahead having been temporarily discontinued to make some exploration. In their stope is from 18 inches to 2 feet of quartz scattered with mineral which assays very high.

The lower level, now in 500 feet, is being worked by three sets of lessees, Jones & Co., Housen & Shavaila, and Howard & Hall, who are all stoping and working on ore of a good class, running at the mill all the way from 105 to 600 ounces to the ton. The stoping thus far done in this level is 200 feet in length and from 40 to 60 feet in height. All the levels are well tracked and freed from *débris*, and it has been a long while since we have been in so clean a mine.

Up to the present time the Clift has produced about $60,000, and, though the work is being done entirely by lessees, it is all prosecuted under the immediate supervision of one of the owners, which insures systematic developments for the future benefit of the proprietors.

The Bonanza tunnel.—This enterprise is now in nearly 600 feet on the west side of Democrat Mountain. At a distance in of 330 feet it cuts the Jordan lode about 120 feet deep. A drift has been run about 220 feet east on the Jordan, which produced with some stoping about $3,000. Two men are driving it ahead all the time. Eighty-five feet beyond the Jordan a blind lode was struck, from 2 to 3 feet wide, with streaks of mineral through it, the average assays from which were 150 ounces. No development has been done. From this lode the tunnel has been run 175 feet in barren ground, but they expect to strike a lode daily, which on the surface looked exceedingly well. The owners expect to strike the Fred Rogers 300 feet below the lowest or 300-foot level within the next 400 feet, and the White Pine 150 feet nearer. The cost of running the tunnel has been from $10 to $15 per foot.

The Moline tunnel is in over 500 feet. It cuts the new Boston lode, upon which a drift has been run 100 feet, with a stope 30 feet long and 10 feet high on 4 feet of solid galena, besides several feet of concentrating ore. A test of several tons gave silver enough to pay for mining and milling, with 54 per cent. lead clear profit. There are 3,000 tons of such stuff on the dump.

On this mountain are also the Nyanza and Famine.

On the Nyanza is an adit 800 feet long that opens the lode 255 feet below surface. There are also two shafts, 45 and 30 feet deep. The lode is being worked, and is producing ore which averages 154 ounces silver and 32 per cent. lead.

The Famine is opened by a 60-foot shaft, which shows a vein with mineralized crevice matter. A cross-cut is being run from the adit on the Nyanza, which will cut it over 250 feet deep.

Republican Mountain has probably produced more money than any other around Georgetown. It rises almost perpendicularly from the streets of this city and likewise from those of Silver Plume, some 2 miles to the northwest, and extends from Democrat to Sherman Mountains. Near its western extremity is the great Pelican Dives group of lodes. On this mountain are also the Lebanon Tunnel and Mining Company, that owns seventeen lodes, ten of which have been cut by their tunnel; the Diamond Tunnel Gold and Silver Mining Company's property; and the Snowdrift, Vulcan, Pay Rock, and Silver Plume.

The Pelican Dives.—This famous mine is located on Republican Mountain, and was first opened up in 1872. It is owned by a New York company, and the total output to date has been upward of $3,000,000. The ore is argentiferous galena. The mine is situated half a mile east of the Terrible, and is supposed to be on the same great vein. The depth is 600 feet. The mine is being worked under lease, and gives employment to about 40 men. The best ore continues to come from the Unicorn; their pay streak ranges from 2 to 4 inches in width, and carries zinc, galena, and gray copper. It mills 250 ounces of silver to the ton. Large quantities of low-grade ore are coming out of the Perdue shaft, and the ore-house looks rich and imposing.

The New Eagle Bird shaft is down 65 feet, and waiting for the hoister.

East of the Pelican Dives is the Diamond Tunnel Gold and Silver Mining Company, relating to which the Georgetown Miner says:

"This property is situated on Republican and Sherman Mountains, in Griffith district, Clear Creek County, Colorado, and consists of ten patented lode-mining claims, mill-site, and the Diamond tunnel. The tunnel penetrates all these veins from the foot of the mountain on the edge of Silver Plume, thereby affording cheap and convenient means of drainage, transportation, and working of its mines.

"Among the most noted of the company's mines is the Corry City. This mammoth lode is leased on surface to Messrs. Ballard & Fulton during the past six months.

"Near the bottom of the old shaft, which was sunk on the north vein and about 130 feet deep, a cross-cut was driven through the vein to the foot or south wall a distance of 17 feet, exposing a rich grade of concentrating ore the entire distance; and on the foot wall of this cross-cut—from whence a new working shaft is being raised to the surface—there is from 6 inches to 2 feet of excellent milling ore, improving with every foot of development.

"A large plant of hoisting machinery and substantial buildings to facilitate more extensive and profitable mining is being put up.

"The company's Diamond tunnel has intersected the great vein at a distance of 2,100 feet from its mouth and at a depth of no less than 1,400 feet on its dip. Very little development on the vein from the tunnel intersection has been done. The lode at this point was split by a large dike, or horse, dividing it into several smaller veins, but all showing small, irregular streaks of very rich ore. There is no doubt but large ore-bodies will be found as soon as this dike shall be surmounted.

"Nos. 3, 4, 5, 6, and 8 lodes have been opened to a small extent from the Diamond tunnel, and show some very promising ore-veins. On No. 8, at a point 40 feet above the tunnel-level, there is 2 feet of nearly solid ore exposed, which improves with development. Nos. 5 and 6 lodes also show small ore streaks in their developments.

"Developments on the company's property for the year are as follows: Four hundred and seventy-two and one-half feet of levels or drifts, 173 feet of shafts and winzes, and 59 feet of tunnel driven. The property is well equipped with ore-houses, shops, cars, and machinery, and the large tunnel is supplied with a double track of heavy iron T rails.

"Mr. J. A. Fish, the company's superintendent, certainly deserves great credit for his management. When he first commenced operations for the company in 1872 its property consisted only of a tunnel-site location, without one foot of development or inch of claims. Now it consists of one of the most extensive and valuable group of mines in the country, with a large tunnel and improvement, all acquired through Mr. Fish's efforts."

On the Pay Rock during December Superintendent Egan put 65 new lessees at work, in addition to the large force previously employed. The pumping out of the shaft below the tunnel-level has opened up again for mining 1,000 feet of levels, which will be rapidly extended. Two pumps, a sinking and a No. 5 Knowles, were used in cleaning out this shaft. The old stull timbers kept their place well. In No. 3 level a scale caved off one side, disclosing about 4 inches of 600 or 700 ounce stuff and 15 inches of ore running from 70 to 80 ounces. Larger masses of ore are now to be seen in the mine than ever before. Its output this winter promises to be much increased.

On the Silver Plume property, situated about 1,300 feet above the town of Silver Plume, on the south slope of the mountain, there are about 4,000 feet of levels and 2,000 feet of winzes, all of which disclose a large amount of mineral. Litigation has prevented this property from producing during 1883.

The Vulcan mine, on Republican Mountain, is in excellent pay. The pay streak upon the tunnel-level second to Mr. J. P. Williams is about 2 inches wide, and ranges from 500 to 900 ounces of silver per ton, while the third class will mill 250 ounces per ton. Snyder & Co. have a lease 200 feet east of the tunnel-level. They have 300 feet of stope. Worthington & Mann are working east and west of Snyder & Co. Outside of these leases the owners of this property are working a portion of the mine on their own account and are doing well. The mine, taken throughout, is reported to pay from $8 to $10 per day to the man.

The Grand View is the name of a very promising prospect on Republican Mountain. A force of miners are at present busily engaged driving the main drift ahead. In the face of this drift, which is 40 feet in length, is disclosed a large and well-defined crevice, carrying mineral of excellent quality. The pay streak proper measures 2 feet in width, and is composed of black sulphurets and green carbonates of copper. The ore mills 60 ounces silver per ton and 74 per cent. lead. The shaft sunk from the main drift is 14 feet deep, and also shows a strong ore-body.

The Lebanon Mining Company own, in addition to the Lebanon tunnel, the lodes formerly known as the Kentucky Group. Ten of these lodes are cut by the tunnel, most of which are blind lodes, more or less developed, and explorations have been made when the lode was cut, and from all of these good ore, milling high in silver, are found. This tunnel is in about 1,300 feet. It cut the No. 10, or Elijah Hise, lode at 1,200 feet, with a depth of over 700 feet. Lessees who have the ground east of and below the tunnel-level say that the shaft some 15 feet east is down about 60 feet, on ore all the way, the streak on the foot wall averaging from 4 to 6 inches and on the hanging, about 4 inches, exclusive of several small feeders between. The lode is 12 feet wide, with fine, hard, hanging wall. The ore averages from 200 to 250 ounces silver and 20 per cent. lead. The air-compressor has a 12 by 13 inch cylinder, and will be run by the 25 horse-power water-wheel in the mill. This will supply a 3-inch air-pipe, which will ventilate the workings and run a hoisting-engine soon to be erected at the shaft. Fifteen feet west of the tunnel is a 60-foot shaft, from the bottom of which a 100-foot level has been run on from 6 inches to a foot of mineral on each wall, running about 180 ounces silver and 20 per cent. lead. The tunnel-level is being run east and west, with good ore in the slope west. Some ten men are working on the No. 10, and more would be employed if the air were better. This will be the case as soon as the compressor starts up. On the No. 5, or Red Bird lode, about fifteen men are working and getting good ore. One party averaged 265 ounces in June. Thus far this month the ore has milled 240 ounces, all in one class. Bad air here, too, is a drawback. Sinking on both No. 5 and No. 10 will be actively resumed with the completion of the compressor."

Snow Drift.—This mine, on Republican Mountain, is now paying handsomely. The property is worked under lease, and gives employment to twenty-three miners. On the level east of the Snow Drift tunnel drifting and stoping are being prosecuted with flattering results. This level is 550 feet in length, and shows up a 6-foot crevice, with a pay streak averaging all the way from 1½ to 14 inches of solid mineral, carrying sulphurets, galena, and gray copper which averages over 200 ounces silver per ton to each mill-run. A distance of 70 feet below the tunnel-level another party of lessees have started a drift east. They have a continuous body of mineral of the same character as that above named. At a point 50 feet above the tunnel-level there are four parties of lessees at work drifting and stoping on a superior quality of ore and taking out splendid pay. In the Good Hope level, 60 feet above, a lease has been let to drift east.

Sherman Mountain is immediately west of Republican, and here is found the property of the Cold Stream Consolidated Mining Company, Dunderburg Mining Company, Mendota, Silver Cloud, and Bismarck.

The Cold Stream Consolidated Mining Company consists of the Scotia, Phœnix, Cavalier, Grenadier, and Maine lodes. These mines have been large producers in the past, but have lain idle for some years, until 1883, when the old workings were cleared out and active operations begun.

The Maine shaft, now 190 feet deep, will be sunk 70 feet and a level run about 150 feet west to connect with the Phœnix shaft, which is now full of water that seeps into the Maine shaft and makes considerable trouble. The ground above the Maine tunnel level is about worked out. The first level below has been run 180 feet west and 300 feet east of the slide in Cherokee Gulch. The second or bottom level is driven 100 feet easterly. This will be continued in the same direction. Both levels contain ore, the second showing from 4 to 5 inches in the breast.

The Phœnix shaft, 150 feet west of the Maine, has a total depth of 360 feet. It is really no shaft at all—simply the sinuous descent of mine gutters, who sank, inclined backward and forward, and underhand stoped, wherever they happened to find ore. The timbers are rotted, and, with the water, make the shaft useless. Thirty feet below the tunnel level a 200-foot drift was run west and gophered. In order to properly open the mine, the new work designed by Superintendent Egan will be patiently followed up, even at a probable expense of $10,000 or $15,000.

The Scotia embraces the ground above a point 35 feet below the tunnel level and west of the Phœnix shaft. William Reynolds & Co., leasing on the second level of the Scotia, have about an average of 10 inches of high-grade ore in their stope. Their mill runs about 400 ounces.

The Dunderburg mine is owned by the Dunderburg Mining Company of New York, and is being steadily worked by a force of about 35 lessees, and produces about $5,000 a month. The deepest workings are 400 feet, with numerous drifts aggregating 540 feet. According to the Colorado Mining Gazette, the production of this mine for a number of years has been: For the fiscal year ending May 31, 1880, the gross production was $92,000; May 31, 1881, $113,005; May 31, 1882, $138,000; May 31, 1883, $106,000. The production the present fiscal year, judging from the production of the past seven months, will not amount to $75,000.

During the time of its greatest production 75 men were employed.

The Mendota, together with the Fulton, Paymaster, Frostbury, and Coombs, a group of claims owned by R. O. Old, will be developed by a tunnel now being driven into this mountain to cross-cut their veins. The tunnel will be 1,050 feet, and will cut the Mendota at 500 feet deep.

The surface area is 1.14 acres. The present developments consist of one open cut on vein and an adit under center of discovery shaft 18 feet; three cross-cuts—respective lengths, 57, 94, and 18 feet, each cutting the vein; four shafts—respective depths, 70, 78, 100—and the discovery shaft, which is 14 feet; five sets of levels, whose respective lengths are, per set, 67, 80, 97, 145, and 225, and two single levels each 30 feet in length; eight stopes, respectively showing 3, 5, 2, 6, 8, 48, 55, and 9 fathoms of ground broken. These workings show a width of crevice from 3 to 14 feet wide, that carries a very heavy ore-vein of galena, mixed with which is zincblende and iron and copper pyrites. Frequently the mineral shows gray copper that is rich in silver; also ruby silver and sometimes native silver. The Mendota is one of the most steady producers of Colorado. Although not an extra large producer, its output has been continuous for some years.

The Silver Cloud is the western extension of the Cashier, on Sherman Mountain. There is a 90-foot shaft where the men are working, but little stoping or drifting. There is over a foot of ore at present uncovered, but of comparatively low grade. In the past ore has been taken out running from 400 to 700 ounces.

The Bismarck mine has 1,200 feet of development, consisting of tunnels, shafts, and stoping. The vein-filling, like that of other veins in this locality, is galena zincblende, rich in gray copper. This lode, together with its associates, the Cataract, McLime, Little Nora, and Little Jo lodes, comprises an area of 25 acres.

A recent mill-run from Allen & Co.'s lease on the Bismarck of 100 sacks of ore returned over 100 ounces silver per ton. The picked mineral ranged from 200 to 300 ounces silver per ton. Henry C. Bates & Co., who are sinking a winze from the second to the third level, have a 6-inch pay streak of solid mineral. The last mill-run of 3 tons gave 43 ounces silver per ton and 12 per cent. lead.

The following description of this property is from the Colorado Miner:

"This lode, located on the western slope of Sherman Mountain, near Brown Gulch, which divides Brown and Sherman Mountains, and one mile from Brownville, was discovered in June, 1866, by a party of prospectors from Central City. The fact that some good silver ore had been found in Brown Gulch attracted them in that direction, and, in climbing upstream nearly a mile, they came upon this lode, which was easily found from the immense outcrop which was plainly seen for many hundred feet along the surface. They then made the location, which was the first one on that mountain or anywhere in that vicinity, the Brown and Mammoth only coming in ahead. The mine now can be traced for over a mile in length by a succession of shafts, drifts, and adits, and what is more remarkable is the fact that its course is nearly due northwest and southeast, while the general course of veins in that locality, as well as nearly everywhere else, is directly opposite—northeast and southwest.

"Some years after it was located the title passed into the hands of the present owners, George W. Cox, John M. Tyson, and Col. James McNassar, since which time they have procured United States patents to the Bismarck proper, the Cataract, which is the northwest extension of the same vein, and the McLin, a cross lode which intersects the main vein at or near the line between the two. This gives them 4,500 feet long by 150 feet wide. Besides this the company own a timber claim but a short distance up the gulch, and easy of access, which will supply them for many years to come.

"The developments, which are principally on the Bismarck, consist of a discovery shaft, an open cut 400 feet long, and an adit run in on the vein 255 feet, which cuts the lodes at the discovery 100 feet deep. This is called level No. 1. Four hundred and twenty-five feet northwest from discovery a cross-cut has been run to the lode, a distance of 50 feet, and a level southeast 120 feet, and another northwest 14 feet, where is a shaft sunk 20 feet. From the bottom of this shaft is a level 25 feet long. This opening is called No. 2 level, and shows a vein averaging 10 feet wide, with an almost continuous pay streak of mineral from 2 to 10 inches in width that milled from 240 to 325 ounces silver to the ton. From these two openings, No. 1 and No. 2 levels, before they were compelled to abandon them on account of water, had produced $18,000 net, which is a good showing when we consider that at the time this ore was sold mill charges for reducing were from $40 to $75 a ton, and packing proportionately high.

"In 1877 the owners started a cross-cut tunnel 650 feet northwest from discovery, which was run 162 feet, where it cut the vein at a depth of 87 feet. From this point No. 3 level has been run easterly a distance of 200 feet, which will gain a depth of 300 feet when completed to discovery, and drain all the upper workings, besides furnishing an easy outlet for the ore. There is a stope in this level which has been worked 20 feet high and 160 feet long which has yielded $8,000, with an average of 207 ounces per ton. At present three sets of leasers occupy this level, except a small block of ground reserved for company work."

Brown Mountain contains many of the largest producers around Georgetown; amongst the many are the Colorado United Mining Company's property, the Seven-Thirty Group, Baltimore Tunnel Company, Telephone, Shively, and Silver Leaf.

The Colorado United Mining Company possesses a large amount of systematically-developed property that has been paying largely for some years. The Terrible, East Terrible, and Silver Ore lodes are worked to a depth of nearly 950, 900, and 580 feet, respectively. The properties are worked by tunnels and the ore-streaks are quite extensive.

The Seven-Thirty mine is situated near the head of Brown Gulch, between Brown and Sherman Mountains, 11,000 feet above the level of the sea, and about half a mile from the town of Georgetown, and is one of the most valuable mining properties of this district. The developments consist of an aggregate of 11,026 feet. In shafts and winzes there are 2,454 feet, and in cross-cuts and drifts 8,572 feet. The property embraces 21 patented claims, extending along a main vein over 1 mile in length and covering an area of over 70 acres. During 1883 from 50 to 70 men have constantly been employed, and 1,317 feet in drifts, shafts, and winzes have been opened. It consists of the following claims:

Hercules.—John E. McCluny, Seven-Thirty, West Hercules, John J. Roe, Maggie, Jennie, John M. Wilson, Clifford, Cora B., Wreckin, Pell Wall, Dolly Varden, Willihan, Buckskin, Griffin, Silver Calf, Exposition, Canned Fruit, Brand Hall, Lady Gunning, and Pio Nono.

No accurate returns of the earlier production of this property are obtainable, but the present owner has receipts for ore from the property of nearly $500,000. The total product is estimated at $1,000,000. The greatest depth attained is only 400 feet, so that these extensive openings are little more than mere prospect holes compared with the extent of the property and its facilities for future development.

Eight levels are being at present driven, all of which show mineral of high grade.

It is intended to sink the main shaft to connect with a cross-cut tunnel, which, when in 1,000 feet further, will cut these veins at a depth of

1,500 to 2,000 feet, and probably open a large stoping ground. The following is a graphic description of this mining property, taken from the Denver Republican:

Seven-Thirty mine.—A trip through the mine found it in good condition, the various workings showing up well, all of the levels showing mineral of good quality in paying quantity, and in some instances the mineral was of exceptionally good grade. As before stated, the Seven-Thirty is located near the head of Brown Gulch, the vein crossing the gulch and running into both Brown and Sherman Mountains. Although 2,000 feet above Silver Plume, in a position on the mountain difficult of access, Mr. Griffin has a good wagon-road all the way to the mine. The present development consists of 7,400 feet of drifts and cross-cuts and several thousand feet of shafts and winzes, all timbered in good shape. This development is the work of several years, and represents thousands of dollars expended and nearly one million of dollars of production. The crevice of the Seven-Thirty lode averages from 4 to 5 feet wide, though in some places it has extended to a width of 25 feet, while most all of this large crevice will pay to concentrate, and doubtless will be saved and concentrated in the near future. For past years nothing but the solid mineral has been saved and milled, and with this the prosperity of the mine has been very flattering. The solid ore-streaks vary in width from 1 to 2 feet, sometimes running even wider. The mineral is chiefly galena, carrying gray copper, ruby and native silver, milling from 100 to 600 ounces silver per ton, at times running as high as 1,300 ounces.

A 40-horse-power boiler is placed at the mouth of the tunnel, which runs the engine 200 feet distant, and two pumps, one 340 feet distant and another at the bottom of the main shaft, 475 feet distant. This lower pump is a powerful Blake sucking-pump and throws 100 gallons of water per minute. The capacity of the boiler and pump is far in excess of anything required at the present time, and will last for years of future development. With blacksmith shop, ore-houses, shaft-houses, machinery, hoister, pumps, cars, rails, and other necessities, the mine is well equipped.

Developments and stoping are constantly going on, the mine being worked night and day. About forty-five men are now employed in the mine. The main work is being done through the Hercules tunnel and engine shaft, the extensive workings above this tunnel not now being worked.

Below the Hercules tunnel six levels are being run, each rapidly gaining depth as it advances. The first level is the tunnel level running east, the second and third are the 140-foot levels running east and west, the fourth and fifth, 210-foot levels east and west, and the sixth the 165-foot level. Mineral is shown in the back stope of each level, and the 210-foot level, especially, shows a large body of smelting ore its entire length, 200 feet, the pay streak being from 6 inches to 2 feet in width.

The tunnel level is somewhat over 1,000 feet long, and shows a good pay streak in the breast, the quartz assaying 120 ounces of silver per ton, and the solid mineral 600 ounces. In the west 80-foot level, below the Hercules tunnel, there has been over $100,000 taken out, and one stope, 50 feet long and from 50 to 75 feet high, produced $50,000.

As before mentioned, all the six levels below the Hercules tunnel are being driven ahead. This work will be continued, and sinking the shaft, which, on account of pressure of other work, was necessarily stopped, will be resumed as soon as the 373-foot level is started east. The level will start in on a large streak of ore.

The ore shipments from the mine usually run from 50 to 75 tons per month, though sometimes the shipments are a little less or more. During the month of August (the September returns are not in) the shipments amounted to 55½ tons of ore, averaging 130½ ounces of silver per ton, or a total of 7,224 ounces of silver, making the output for August $7,500, not considering lead.

All the ore taken from the Seven-Thirty is of an unusually good grade all through, and while August's returns showed an average of only 130½ ounces of silver per ton, much of the first-class mills over 1,000 ounces, as the following mill returns, taken from the returns for one month alone, show: 1,222 ounces, 1,206 ounces, 1,315 ounces, 1,120 ounces, 1,362 ounces, and 1,457 ounces of silver per ton, and this ore came from the level 80 feet below the Hercules tunnel.

On the whole, the Seven-Thirty is one of the best mines in the country. It has made a splendid record for past years, and will doubtless continue its good record for years to come. It is well equipped with machinery and supplied with plenty of timber and water to last for years.

The Baltimore Tunnel.—The Baltimore tunnel is over 700 feet long, and cuts the Fenton, the Baltimore, the Queen, and two other lodes. Mining at present is confined to the Baltimore lode, which the tunnel cuts less than 100 feet deep. Near the surface and 300 feet west of the tunnel, Ed. Gardrill is leasing and getting out ore that mill-runs between 500 and 600 ounces. Twenty feet west and 60 feet above the tunnel level, Messrs. Stanton & Co., are taking out, under lease, ore whose first class runs 504 ounces; second class 210 ounces. Justice William H. Roberts & Co., are driving the tunnel level ahead westerly under lease, and are now 400 feet from the tunnel. There is considerable ore scattered through the breast. A mill-run three weeks ago gave 139 ounces, all in one class. The last 100 feet has been run on the hanging wall, and a cross-cut of about 10 feet will be made to the foot wall, which has hitherto carried the best mineral.

The first level below the tunnel, called No. 2, is worked out to the east end line, and is in 360 feet west of the shaft. Fitzpatrick & Co., lessees, are drifting and stoping on a small ore streak. Their last shipment returned 230 ounces.

Level No. 3 has been driven 350 feet west of the shaft. Little stoping has been done. Messrs. Parry & Co. are drifting and stoping. They have a streak of nice ore which runs 325 ounces. From this level Superintendent Fillius began sinking, and has put the shaft down 148 feet further, as already mentioned.

Level No. 4 was run, under his management, easterly to the end line and westerly 100 feet. Messrs. Vivian & Co. are leasing on the west, and have from 2 to 5 inches of ore in the stope and breast. Their last run gave over 500 ounces, and none went under 150 ounces. A nice streak was uncovered in the breast of the drift Tuesday evening.

The fifth level will be started east and west from the bottom of the shaft, 258 feet below the tunnel level, by Bryant & Co., going west, and by Symonds & Co., going east. The latter sunk a winze 138 feet east of the shaft, on the fourth level, 70 feet deep, and drifted west 80 feet. They have 56 feet to go to make connection, and will run that from the Baltimore shaft, as stated above, on account of facility in hoisting. A fine streak of mineral was found in the bottom of the shaft, and is supposed to be the same streak found above pitching east.

The Telephone, near the head of Shively Gulch, is developed by over 1,000 feet in shafts, drifts, and tunnels. There is a 6-inch streak with

125 feet to stope up on. The breast of the level is in over 100 feet, and the ore streak has varied from 18 inches to the present inch vein. The ore is a fine-grain galena and sulphurets averaging 375 ounces silver per ton for first class and about 120 second class. But little work was done on the Shively during the first six months of the year. During the month of August four men were engaged, with the assistance of a 75-horse-power boiler and 50 horse-power engine, pumping water out of the shafts. Since then it has been worked by thirteen lessees, all of whom are extracting ore.

The Silver Leaf, above the Shively, is being put in order. The old tunnel has been cleaned out and will be continued from its present length 150 feet, until it strikes the main vein, which is about 100 feet further on, thereby cutting the vein 150 feet deeper than its present workings. The ore, which is a zinc and galena, runs about 150 ounces silver.

The Hardscrabble Group, on Hanna Mountain, near the Shively, is composed of the Hardscrabble, Avalanche, Miner Girl, and Dixie. The property is being systematically worked. A drift has been run 362½ feet on the Hardscrabble, cutting the Avalanche about 359 feet in. A drift has been run west on the latter about 60 feet. It shows a strong quartz streak, in some places 2 feet wide. It carries considerable mineral, galena, gray copper, and zinc. The greatest depth attained is 250 feet. In about 90 feet more the drift on the Avalanche will be under a shaft now 50 feet down, and a raise of 150 feet will be made to it. The shaft showed fine mineral, including some ruby, brittle silver, and galena at the bottom, and sulphurets, gray copper, and galena going down.

Kelso Mountain is close beside Irwin's Peak and opposite the circling McClellan Ridge. The Atlantic and Pacific tunnel are working at the base of the mountain. The heading is now 1,500 feet in blue granite. The tunnel is to run under the center of Gray's Peak at a point 3,400 feet from the surface. The rock for 100 feet has been unusually hard. Before that a spur was driven on some 200 feet, which, however, circled in and out of the line of the tunnel like a wave. It contained soft gangue and some mineral that ran as high as 47 ounces of silver. Fifteen men are employed, and the heading is supposed to be within 50 or 60 feet of the Diamond Joe.

The Potosi lode was struck some 500 feet in. Upon this Messrs. Snow & Riggs have drifted under lease 175 feet westerly, having a depth at the breast of over 600 feet. The crevice has specks of mineral and looks more promising than heretofore.

The Silver Ledge has a drift some 25 feet in the vein with a shaft 25 feet deep, while several open cuts demonstrate that the ore-body is of great width. The dump is all ore; that is to say, the entire amount is concentrating ore that will pay well to handle. Streaks of clean ore occur through the main. The present shaft will be sunk some deeper and then a drift run back under the present drift to tap a vein of rich ore encountered near the edge of the creek, and which it was thought advisable to sink on, on account of water. A lease some 150 feet from the present workings has been let to Messrs. Moizan and Applewhite. These gentlemen propose to sink 100 feet or more and then drift and stope. An open cut and shaft already down some 15 feet give promise of a good ore-body at no great depth.

The Diamond Joe mine, formerly known as the Brooklyn, after a lapse of nearly five years, resumed work in June. The work of exploration is confined at present to levels Nos. 1 and 2 and the ground between, where there lies untouched ore reserves. A car and track have been sent up and will be put in level No. 2 at once. This level will be extended east ward. It is now 650 feet in length. From the winze that connects these two levels a blind drift has been driven west 30 feet for the purpose of prospecting the ore-body. Some 60 feet west of winze No. 1 another winze has been started southerly disclosing some very rich ore. It is now 65 feet in depth. Cross-cut drifts from level No. 1 will be run for the south wall of the lode. Above level No. 2 up to the surface the ore has been worked out. The owner is much pleased with the leasing system now in vogue, and is putting his property in shape prior to leasing it out in small lots. The ore from this mine mills from 196 to 500 ounces silver per ton. This property will be worked uninterruptedly, and will be one of the regular shippers.

The British Queen Mining Company own on Kelso Mountain the Baker mine. Messrs. Edward Holcomb, Peter Yost & Co. have a lease on the third level and are opening up some good ore in an old stope 150 feet from the mouth of the level. They have from two to four inches of very rich ore for a long distance, and will commence shipping in a short time. The Baker mine has over one mile of levels, shafts, and winzes, that produced large sums of money ten and twelve years ago, and have been mostly abandoned since. The company have commenced within the last year to clean out these old openings, and with very satisfactory results.

The Woodchuck mine, running parallel with the Diamond Joe, on the south, is being steadily worked by one shift.

Messrs. Holbrook & Co. have been working their contract on the Detroit lode, Kelso Mountain.

The Vermont lode is a short distance above the Atlantic and Pacific tunnel. It is opened by two levels. The upper or main level is run on the vein and is 180 feet in length. The pay streak in the face of this tunnel ranges from one to five inches solid, while the main crevice is 4 feet wide and is interspersed throughout with mineral. The first-class ore, sorted, averages from 900 to 1,000 ounces silver per ton. It is a galena and sulphuret ore. At a distance of 75 feet below the No. 2 level is reached. This level is about 90 feet in length, and for a distance of 60 feet it is a cross-cut. From that point on it is driven on the vein, the character of the ore being the same as that found in the upper workings, and the first-class mineral averages over 400 ounces silver per ton.

The Mint Mining Company own the Mint, Mint Extension East, Mint Extension West, Tornado, Coachwhip, and Pocahontas lodes. The principal development has been on the Mint and Coachwhip. All the lodes will be worked through an adit, now being driven, cutting the veins at a depth of about 200 feet. The principal mines located on McClellan Mountain are the Northeastern Stevens Mining Company, Independence, Boyd, and Richmond.

The Northeastern Stevens Mining Company own the Stevens, Dividend, Columbus, and Colonel Hall lodes, and two mill-sites. The aggregate amount of development is about 500 feet in drifts and cross-cuts.

The Independence has been one of the best-paying mines in this locality, and is developed by a main tunnel 710 feet in length, having a depth in the breast of 400 feet. On this tunnel are four shafts, 35 to 80 feet in depth. In one shaft, at a depth of 60 feet, is a drift 100 feet west, showing a streak of mineral 4 to 8 inches of galena, which mills 70 ounces silver per ton. The best-paying ore just now comes from a stope about 125 feet from the tunnel mouth and 60 feet above it, now under lease to J. B. Johnson. At 440 feet is a pay streak from 6 to 12 inches wide that mills from 216 to 316 ounces silver per ton. Four hundred feet from the mouth of the tunnel is a winze connecting the main level with the next level 110 feet above. In this level the streak is from 3 to 5 inches, milling about 80 ounces per ton.

The development of the Boyd consists of a cross-cut tunnel which intersects the lode; is 131 feet in length. From it a drift has been extended east 100 feet, also one west 20 feet. The vein between walls measures 35 feet, and the pay streak runs as high as 2 feet in width. There are now 6 inches of solid ore in the east drift, mostly galena. In the face of the west drift there are 18 inches of quartz, with mineral scattered through it. From the tunnel level, some 50 feet east of the breast, a shaft has been sunk a depth of 20 feet, disclosing a continuous body of mineral, about 6 inches of which is solid pay. Some 20 feet east of the tunnel level there is a 25 foot raise, showing a 3-inch solid pay crevice. At present the work is confined to the west drift and the raise. Shortly, however, a force of men will be put to work driving the drift east and also sinking the shaft. The character of the mineral is galena and blue and green carbonates of copper.

The Richmond lode has been developed by adits, cross-cuts, and drifts to the extent of 250 feet. The deepest workings are over 100 feet. The crevice is 10 to 12 feet between walls, and contains three pay streaks, which, taken together, make fully a foot of ore. The lode is being steadily worked. The ore carries 25 to 40 ounces of silver and from 60 to 70 per cent. of lead.

On Leavenworth Mountain is the Equator tunnel, through which the Ocean Wave and Alabama lodes are worked; also the Sacramento, Kirtley, Coulter, Burrell, and Branagan.

The Equator tunnel is 1,400 feet long, being at the limit of the property belonging to the Equator Mining Company. The heading at the west end of the tunnel is about 650 feet beneath the surface. The last 600 feet of the tunnel shows a continuous vein of ore from 1 to 12 inches wide; on the Ocean Wave lode no stoping has been done over the tunnel with the exception of a single block of ground 25 by 30 feet, and there are no surface workings except the discovery shaft near the entrance of the tunnel.

The Alabama is worked through the Equator tunnel under a lease; the pay streak shown on either side of the tunnel is small, but the ore is rich, milling from 250 to 450 ounces silver per ton.

The Sacramento is located west of the Equator. It is developed by a main drift 125 feet in length, showing a large and well-defined crevice with mineral interspersed throughout; another drift further down the mountain, 250 feet in length, discloses the same crevice 14 feet wide with ore more compact.

The Coulter is worked through a cross-cut tunnel with good results.

The Kirtley is extensively opened by shafts and drifts; the Kirtley tunnel, which is being run, will intersect this vein at a depth of 300 feet from the surface.

The Isothermal is worked through a cross-cut tunnel 155 feet long; the mineral, though scattered, is very rich.

The Colorado Central, owned by the Colorado Central Mining Company, has been worked for eight years; during this time the out-put has been about $800,000. The deepest workings are at 500 feet.

The Ben Curtis is opened by a 600-foot tunnel which intersects the vein about 300 feet from the surface. A level has been run east 290 feet. At 150 feet about 300 fathoms of ground has been stoped.

The Burrell is worked through an adit 175 feet long; the vein, which, near the surface was narrow, has widened to about 4 feet, with iron and copper pyrites and galena scattered throughout.

The Branagan is opened by a cross-cut tunnel 200 feet in length; drifts run on the vein both easterly and westerly, showing a pay streak of ore from 4 to 14 inches. Shafts sunk in these levels disclose this same ore streak. The ore is high grade, and by proper working this property will produce a large quantity of bullion.

The Yellow Jacket, located on the northwest side of Leavenworth Mountain, is a very promising claim, and is owned and operated by Mr. Hamilton. There is a drift on the vein 15 feet in length, besides a shaft from this drift 28 feet deep. The ore-body is continuous throughout the whole distance opened. The ore is iron pyrites, carrying from 40 to 150 ounces silver, 1½ ounces gold and 12 per cent. copper. The pay streak measures from 1 to 3 inches solid. The work of sinking main shaft goes on uninterruptedly.

On Saxon Mountain is the Anglo-Saxon, the Saxon Extension Group, Pickwick, Dunbarton, and the Summit Consolidated Mining Company's property.

The Anglo-Saxon was not worked during 1883; the developments consist of four levels with numerous cross-cuts and shafts. The ore-vein is narrow but rich, and has yielded about $700,000 since it was discovered.

The Saxon Extension Group consists of nine claims, the Saxon Extension being the best developed, possessing in adits, cross cuts, and shafts about 505 feet, the deepest workings on the lode being 200 feet.

The Pickwick is worked through a tunnel 600 feet long. The ore is high grade, the pay streak from 2 to 12 inches.

The Dunbarton is worked through an adit 450 feet long; the vein shows 8 inches of solid mineral and two feet of gangue permeated with mineral. The ore is low grade in silver, but contains about 65 per cent. lead.

The Summit Consolidated Mining Company owns the Summit, Port Jervis, Bunch, and Precinct mines. The main shaft on the Summit vein is down 170 feet, and a contract recently let calls for 60 feet more, when new levels will be run east and west. The main adit on the 110-foot level is 390 feet in length. From this level, at a distance of 150 feet from its mouth, a cross-cut is run east 125 feet, at a distance in of 70 feet.

The Precinct lode was cut, in which a drift 75 feet was run, disclosing a good body of mineral. In this 125-foot or main east cross-cut, 19 feet from the Precinct lode, what is supposed to be the Port Jervis lode was struck. This vein measures 20 feet between walls. The east cross-cut will be continued until it cuts the Bunch lode. Throughout all the workings of this property good mineral is found, but development is required to make it one of the prominent producers around Georgetown.

On Griffith Mountain the Hood lode is intersected by an adit 234 feet from the surface. In addition to the adit there are 440 feet of shafts and drifts, all showing good mineral.

In the vicinity of Idaho Springs, on Seaton Mountain, are the Seaton, Gem, Tropic, Metropolitan, Veto, Queen, Fourth of July, and many others. Into this mountain the Foxhall tunnel is being pushed to work a number of veins; the length is now 630 feet.

The Seaton has been worked but very little during the past two years, waiting for the Foxhall tunnel to cut the vein, which it will do at a depth of 600 feet. On this vein there are 480 feet of shafting and 640 feet of drifts.

The Gem is developed by a shaft 320 feet deep. On the vein are 375 feet of levels and 284 feet of adits. This property was idle most of the year, and but a small amount of bullion was extracted.

The Metropolitan is worked by a drift on the vein of 300 feet long, which throughout its entire length discloses a strong vein of mineral.

The Tropic, one of the largest producers on this mountain, is developed by a shaft 360 feet deep, from which four levels are run, ranging from 400 to 800 feet in length. This property is worked by lessees, who have extracted during the year considerable ore from the second and third levels.

The Veto has a crevice 8 feet wide, with a pay streak 13 inches. The shaft is 300 feet deep, and in sinking to that depth the owners have taken out over $100,000. No stoping has been done since sinking the shaft the last 150 feet, and at the bottom the ore is solid and has been so for quite a distance, showing that there is quite a stoping ground above. The ore is gray copper and galena, carrying from 150 to 250 ounces silver per ton.

The Fourth of July, on this same mountain, is destined to be worked by the Foxhall tunnel. The developments consist of one shaft 262 feet deep and five other shafts aggregating 200 feet. Levels are run both ways from the main shaft, disclosing a continuous vein averaging 18 inches in width that mill-runs 200 ounces silver per ton.

The Great Republican mine is the extension of the Little Mattie vein. The present developments consist of a shaft 160 feet deep from the surface. Above the first level the raise is 25 feet. This level has been run a hundred feet. The second is 40 feet deeper, and the third 95 below this, with 150 feet of drift. In the third level there is a mineralized streak 2 feet wide. The average width of the solid high-grade ore is 4 inches. This mine is situated on Seaton Mountain, running between and parallel to the Veto and Gem mines, only 100 feet from the former. Its developments consist of an adit 180 feet in length and a shaft 120 feet in depth, from the bottom of which a level is run for 60 feet, over which considerable stoping has been done. The fissure is 6½ feet wide, with 8 inches of solid ore on the foot wall and 18 inches on the hanging, besides streaks running through the center of the gangue, the whole of which is mineralized, bringing the actual ore-body up to between 4 and 5 feet, it is claimed. The ore is of fair average richness, and on account of its quantity insures large returns to the owners.

The Queen possesses seven shafts, from 10 to 230 feet in depth, and about 400 feet of drifts. The pay streak averages 10 inches, carries gray copper and galena, with probably 150 ounces silver per ton.

The Hoosaic Mining Company, owners of the Little Mattie, are working thirty men on the property, which is situated on a small gulch running into Chicago Creek, and it is being rapidly and substantially developed. The shaft is down 300 feet. The 150-foot level is over 225 feet west of the shaft, and the lower or 250-foot level has been run 175 feet. All the workings show a good ore streak, while for the year past stoping has been carried on in the upper levels. The ore carries gray copper, zinc, galena, ruby, brittle and native silver. The pay streak is about 12 inches wide and is very rich. On the surface every necessity in the way of machinery requisite for extensive workings is of the very best, and capable of doing everything required.

The Freeland, 4 miles from Idaho Springs, on Trail Creek, is in the best condition possible, and enough ore is in sight to keep 25 men stoping for a number of years. The company owning this mine, rather than pay the high rates for transportation reduce, a very small portion of the ore that might be extracted at the Bullion smelter near by. The ore is low-grade and requires concentrating, but is of such a character that concentration is but a small item in the expenses. It carries both gold and silver. The mine is opened by tunneling to a depth of 900 feet, which is the adit level. From this point three levels have been run on the vein. The total number of feet in drifts is about 6,400 feet, upraises 1,000 feet, and shafts 850 feet, making a total of 9,150 feet of development. T-rails are laid and cars run through all the levels. Although the Freeland mine is capable of producing 200 tons of ore per day, the actual production has averaged about 50 tons.

The Colorado Mining Gazette gives the production of this mine for 1883 as—

| | |
|---|---|
| Gold | $152,351 15 |
| Silver | 48,922 92 |
| Copper | 7,189 54 |
| Total | 208,453 71 |

This represents only the production for the first nine months of the year. No ore has been milled since October 1, as it is the intention to wait until possession is obtained of the smelter recently purchased. The entire product as given above was treated at the Dumont smelter.

The Gum Tree mine, near the Freeland, is developed by an adit 1,000 feet in length and a shaft 150 feet. A good body of mineral is shown through all these workings, consisting of galena and gray copper that carries an average of 50 ounces silver and about an ounce of gold per ton.

The Donaldson, on Kelly Mountain, owned by the Kohinoor and Donaldson Mining Company is extensively developed by shafts, adits, and drifts. The vein filling is copper and iron pyrites, gray copper, zinc, and in the ore streak is found free gold.

In addition to the pay streak, which is from 6 to 12 inches, there is 3 feet of concentrating ore.

The Champion, on Bellevue Mountain, also belongs to the Kohinoor and Donaldson Mining Company. It is worked by a shaft 650 feet deep, from which are numerous drifts, the aggregate of these being about 800 feet. The vein at the bottom of the shaft is from 6 to 8 feet wide, with the exception of the pay streak, which averages 18 inches wide. This entire vein-filling is a low-grade ore, that is easily and economically concentrated.

The Silver Glance, located on Chicago Creek, 2½ miles from Idaho Springs, has just been put in first-class condition, by being substantially timbered and the placing of all the necessary machinery and buildings. The developments, which consist of a shaft 200 feet deep and an aggregate of 500 feet in drifts and adits, are being rapidly pushed.

The Great American, in Hukill Gulch, is developed by a shaft 75 feet deep and a cross-cut tunnel 60 feet. The vein is of good width, being composed of an oxide of copper that assays 19 ounces gold, 16 ounces silver, and 40 per cent. lead.

The Crystal mine, on Seaton Mountain, is being extensively worked. It is owned by the Fulton Gold and Silver Mining Company of Pennsylvania, and is developed by an adit now in 200 feet, showing 8 inches of nearly solid ore in the breast. Some back stoping has been done in this adit, and nowhere shows less than 5 inches of mineral. At a distance of 200 feet east of this adit a shaft now down 90 feet, with a level west at this depth 35 feet—mineral has been carried the entire length of this level varying in thickness from 5 to 18 inches. Back stoping is being done in this level. At a distance of 200 feet east of this shaft another shaft of 55 feet is being worked by Mr. J. R. Bigger & Son. The ore averages $100 per ton.

The Tropic, one of the old producing mines in Virginia Cañon, has about 3,200 feet of drifts and two shafts, one being 275 feet and the other 180 feet in depth.

At Camp Clifford, on the Clifford mine, developments consist of 900 feet of levels, extending each way from a shaft 100 feet deep. This property has produced no bullion during 1883, although there is considerable in sight. The vein is irregular, varying from 1 inch to 8 feet, the vein-filling being galena and gray copper carrying silver. New machinery has been purchased and new buildings erected during the year, and the property is now in good condition for production.

The U. P. R., in *Lower Fall River mines district*, is developed by a main shaft 118 feet deep, drifts 100 feet, and a main adit 50 feet. The entire openings disclose a continuous ore streak of iron and copper pyrites that runs well in gold. There is a good stamp and buddle mill about one-half mile from this mine, which is run by water-power, and affords excellent facilities for treating the ore.

At Fall River the hydraulic mines of the Alice Mining Company are the most extensive placers in the county. This company owns 1,500 acres of placer land in the forks of Fall River and Silver Creek, 8 miles from the mouth of the river, and within 3 miles of its head, hence at a high altitude—probably over 10,000 feet. The valley of Silver Creek, where the mining is being done, is three-fourths of a mile wide and about a mile above the junction of the streams. Quite a high ridge lies between the streams, and it is on the eastern slope of this ridge that operations are being carried on. About 700 feet of pipe is used to carry water to the giant, which is 8 inches in diameter at the sand-box. The fall is sufficient to throw a 3½ inch stream 200 feet. The *débris* removed consists of from 3 to 6 feet of coarse gravel and soil, 2 feet of fine yellow dirt, and about 3 feet of shattered bed-rock, which consists of white and gray talcose rock, filled with vuggs of quartz crystals and iron pyrites. This talc has been uncovered for a distance of about 500 feet in length and 200 feet in width, and runs in a northeast course. On the north side the talc joins a dike of porphyry. The southern extremity has not been uncovered. The yellow dirt immediately overlying the talc is said to be quite rich, and will wash an inch string of gold to the pan. The *débris* is easily removed, and but few large bowlders met with. On account of the precipitous ground the flume is less than 100 feet in length, with a dip of 5 inches in 12 feet.

The ground washed at present is known to be much richer than any heretofore washed, and the gold coarser. Considerable native silver is found in the sluices, one chunk as large as a hen-egg being found a short time since. Work is kept up day and night, several large locomotive headlights being used at night. The company has a line of pipes laid at the lower end of the placer, but no work is being done at that point. It was the intention to make a cut to bed-rock from the upper to the lower end of the placer, a distance of over half a mile; and for the purpose of ascertaining the depth to bed-rock a 40-foot shaft was sunk at the lower end, but failed to touch bottom. The company is a Nebraska organization, and has a capital stock of $2,000,000.

The Eclipse mine is situated about 6 miles from Idaho Springs, on a thickly wooded mountain, three-quarters of a mile from Chicago Creek. Twenty men are employed in its development. The main level is being driven with all possible dispatch, and is now in a distance of over 400 feet. The crevice is fully 5 feet wide, with smooth, regular walls. The pay streak measures 5 inches of high-grade ore.

*Cascade district.*—In the stope over the main level it is said there are 60 feet in length of the vein, averaging in width 10 inches, which it is thought reaches to the surface, 150 feet above.

Stope No. 2, east of shaft and below main level, is said to be yielding $200 to the fathom. The breast of the level below this stope shows a solid streak 6 inches wide. The ore-body in the shaft looks well, and extends to the depth, now reached, of 100 feet, where the pay streak contains 3 inches of gray copper that mills $900.

The management is very systematic in their development. There is no gutting, the stopes being properly blocked out and worked overhand, leaving all the poor dirt between walls as supports.

On the Mountain lode work has been resumed. The shaft at 10 feet showed a fine streak of free gold ore, running at the mill 1 ounce in gold and 12 ounces in silver.

The Silver Link lode of John Guignan has lately improved very much, the pay streak increasing in width as the upper level is driven ahead. The lower level is soon to be started ahead. There is on the dump some very high-grade ore.

The lower adit of the Prussian is in about 35 feet and is steadily going ahead. It is owned by the Cascade Mining and Development Company.

Mr. Vesey has obtained a depth of 25 feet in the shaft of his Forrest Hill lode, Cascade mining district. There is a pay streak of 14 inches highly mineralized quartz, carrying large quantities of green carbonates of copper on the hanging wall.

The Eureka lode, struck in Cascade mining district, is developed by a shaft 83 feet deep, and an adit now in 40 feet.

The Georgetown Courier gives the production of this county for the past year, as follows:

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|---|---|
| Argo works | $725,000 |
| Grant works | 265,828 |
| Miners' works | 171,355 |
| Golden works | 321,615 |
| Dumont smelter | 208,453 |
| Matthews & Webb | 37,762 |
| Credited to Gilpin County | 250,000 |
| Gold from placers and other sources | 50,000 |
| Miscellaneous | 100,000 |
| Total | 2,130,016 |

I have placed the production of this county for 1883 at: Gold, $250,000; silver, $1,580,000; total, $1,830,000.

## CUSTER COUNTY.

Custer County extends from the Sangre de Christo Range to the borders of the Plains. The mining district, embracing but a small area, is known as *Hardscrabble district;* this is divided into two districts, or rather mineral belts, one containing milling the other melting ores. This county is remarkable for the peculiarity as well as the richness of the deposits; yet, for reasons best known to those most interested, some of the best mines have lain idle, and the mines have not produced within 50 per cent. of the bullion that should have been placed to the credit of Custer County. The two principal camps of this district are Silver Cliff and Rosita, Silver Cliff being in the belt of smelting ores. The mines of Silver Cliff lay idle during 1883, and but little can be credited to that locality, but around Rosita there has been much activity, especially during the latter half of the year. A number of new strikes were made, and many supposed worked-out mines resumed shipping ore. The property of the Bassick Mining Company, the Maine mine, is situated on a spur of Mount Tyndall, the formation of which is trachyte and conglomerate, while that of the main mountain is chiefly feldspar. The fissure or crevice constituting the ore-body of the Maine mine is peculiar in this, that it has no defined walls of country rock, the mineral-bearing portion not differing from the surrounding country rock except in its richness of the precious metals. The portion bearing this richness is contained in a coating or covering of mineral, on bowlders or pebbles of trachyte, the bowlders containing nothing of value. The mineral covering of the bowlders or nodules is usually in different layers, which frequently are distinctly marked. The innermost is composed of sulphides of lead, antimony, and zinc, the second in blende, and often a third coating of copper pyrites. All these layers contain gold and silver in varying proportions. The outside coating is the richest in gold, but the second, or coating of blende, constituting the larger portion of mineral, is the greatest source of wealth. The ore-body appears to be an immense chimney rather than a fissure, and the workings are rather on the order of quarrying. The lowest level reached is 1,000 feet. On the eighth and ninth levels the vein began to widen, disclosing ore-chambers of magnificent extent and of a richness equal to anything so far found. A new working shaft is being sunk large enough to accommodate two large-sized cages, which will finally connect with the present lower workings of the mine. New pumping machinery is also being added, as the mine is troubled considerably with water.

The Bull Domingo is about 5 miles from the Bassick, towards Silver Cliff, and is similar in formation, except that the mineral carries silver only. The history of this mine dates from the fall of 1878, when the Hunter Brothers, Caldwell and Martin, placed their discovery stake upon the outcroppings of its wonderful ore-bodies, christening it the Johnny Bull. Shortly afterwards J. Y. Thyng and others located substantially the same territory, under the name of the Saint Domingo, and the Bull Domingo war of force and arms and law and courts gave its vast ore-channel a reputation throughout the country. From that time until the summer of 1881 the mine stood in the front rank of ore-producers of Southern Colorado, having made a total production up to that time of between $300,000 and $400,000. During the summer of 1881 operations were suspended by reason of losing the ore-body, and as the company had expended its earnings in making improvements upon the property and in building a concentrator on Grape Creek, no funds were available for the purpose of making such explorations as would be necessary to again locate its ore-channel, and the Bull Domingo passed into that somnambulistic condition that forms a part of the history of so very many valuable mining properties.

Early this year the Bull Domingo Company were reorganized, the judgments and debts against the company having all been bought in by the new company, and the old stockholders allowed shares in the new company equal to those held in the old, on the payment of $1 per share, and this summer active operations were again renewed upon the property, and already the results of these operations are of the most satisfactory character.

The main shaft is perpendicular, and at that depth is over 200 feet south of the vein. As it leaves the shaft the drift passes through a heavy blue granite for a distance of about 140 feet, when the character of the ground changes to a bowlder formation, and this character of ground has produced the $300,000 or $400,000 taken out of this mine. It is this same character of formation that has poured the unceasing stream of wealth of the Bassick; but passing through this the end of this drift reaches what has always been held heretofore to be the hanging wall of the mine, 219 feet north of the shaft line. At this point the late find of rich ore was made and the ore-body is lagged up for the purpose of further explorations. Here the drift turns to the east and follows this wall 35 feet, where an upraise is being run on the dip of the wall. Along here the evidences of mineral value increase. The former manager of the mine adhered to a theory that this was a true wall, and no ore behind it, but the present manager believes that the main ore-channel lies behind it, and that only a body of granite stands in the main ore-channel, and the numerous mineral spurs come from the back of the wall. While only explorations are being carried on at present, considerable ore is being surfaced, and, while the new developments of mineral are already extensive and substantial, it is our firm belief that these explorations are now on the border of an ore-channel which will outrival those of the upper levels.

The Leavenworth is coming to the front as a steady producer, with a daily output of from 2,500 to 3,500 pounds of ore per day, while but a small portion of her ore-channel has been opened. It is being worked with one shift at present, but a force will be put to work sinking the shaft and more ground will be opened this winter. There has been better ore taken from the lower level of this property than from any other place in it, but it was condemned by incompetent managers and the ground abandoned. However, this ground will soon be reopened, and, as the mine is in careful hands, there is no doubt that the Leavenworth will maintain a good reputation as a mine. The developments consist of a shaft 300 feet. At 150 feet is a level 200 feet; at 200 feet is a level 350 feet; at 250 feet is a 150-foot level; and at 300 feet is a level 75 feet. No stoping has been done below the 150-foot level, as below that point the workings are filled with water. Heavy machinery will be placed during the winter and the water drawn off, after which a large force of men can be worked.

Near the Leavenworth is the Concord, a property that looks promising. The shaft, 85 feet, has disclosed a body of burnt quartz spar and carbonates, intermingled with oxides of lead, that run 40 ounces silver and one-half ounce gold per ton. During the winter the mine will be developed by drifts and adits.

The Pocahontas mine, near the Leavenworth, has a shaft 200 feet deep, with drifts at every 50 feet. During 1883, only assessment work was done.

The Leviathan, on the same vein as the Pocahontas, has a shaft 320 feet deep, with a level 196 feet in length at 200 feet from the surface, and at 300 feet is a level 365 feet west and 120 feet east. The vein averages 15 inches and runs about 50 ounces silver per ton. The property is being supplied with machinery, and will be worked extensively during 1884.

The Valley City Mine Company have been steadily developing the California lode. The shaft is down 153 feet, and drifts are run north and south 40 feet.

The Humboldt mine, which produced largely at one time, again resumed operations, and is being put in first-class condition. The property is developed by a shaft 600 feet deep; levels are driven at intervals of 100 feet. A cross-cut, starting at 400 feet down the shaft, was driven nearly 200 feet at right angles from the vein to explore the ground, into which ore-feeders were found to branch in sinking the shaft. Beyond the finding of occasional ore-seams this cross-cut amounted to nothing. The explored ground has been exhausted for a depth of 400 feet, and the workings now are on the 500-foot level. In this is found an ore-streak 8 inches, very rich in ruby silver and gray copper.

The Virginia, an extension of the Humboldt, has not been working during the year. On this property is a shaft 435 feet deep and 800 feet of levels.

The Twenty-Six mine has been working under a lease and produced some ore. During the winter the lessees will put the mine in good shape for extracting ore the coming season.

The Susan Jane, near the Bull Domingo, is undergoing a course of development. The tunnel now is 123 feet; has cut four ledges, from which it will pay to extract ore. The main vein is expected to be cut during the winter.

On the Nellie mine, near Rosita, is being placed hoisting and pumping machinery. After this is in working order this property will begin producing, the character of ore being black sulphurets and sylvanite.

The Michigan has a shaft 130 feet deep. A drift at 60 feet exposes a streak of 9 inches of galena, zinc, and gray copper that averages 68 ounces silver per ton. At the 100-foot level, which is 90 feet in length, is disclosed the same character of ore seen in the other workings, except that it carries some gold.

In Silver Park the mines are showing encouraging results. The veins here are large, with an iron carbonate as oxide, carrying some gold and silver from the surface, invariably improving with depth. The formation of the country rock is granite.

The Franklin mine is an old location, but has never been systematically developed until during this year, since which time it has been made to pay expenses. It has no deep developments, but shows large bodies of mineral in every drift and level, and the vein is worked by a tunnel 140 feet long.

The Supposition is being worked by a tunnel 40 feet; the vein is 30 inches, the ore a low grade. The ore of this property is desirable on account of the iron for fluxing purposes.

The Racine Boy and Silver Cliff lodes, the property of the Silver Cliff Mining Company, have not been worked, and the mill belonging to this company lies idle.

The Plata Verde, on Round Mountain, has also been idle. The Kate mine, an extension of the Racine Boy, is undergoing a course of development preparatory to production. A concentrator has been built on Grape Creek; also a tramway connecting the mine and mill.

West of Silver Cliff is the Sangre de Cristo range. E. C. Bassick is developing the Venezuela lode. The vein and vein filling is similar to that found around Georgetown (gray copper and galena). The shaft is 600 feet deep. A level at 200 feet from the surface is driven 120 feet; another level is being driven at 600 feet. Between walls the vein measures on an average 100 feet. The mineral is scattered, lying in five different streaks, which are gradually nearing each other.

The Zoo, an extension of the Venezuela, possesses the same characteristics. The shaft is 175 feet deep, but operations have been discontinued on account of water.

The Wet Mountain Tribune, of Silver Cliff, reports the production of this county for 1883 to have been:

| | Tons. |
|---|---|
| Shipped out of county | 2,266 |
| Reduced with in county | 1,277 |
| Total output | 3,543 |
| Estimated value | $857,450 |

The average monthly product was 377,671 pounds, or $71,454. I have placed it at: Gold, $620,000; silver, $200,000; total, $820,000. This shows an increase in gold over 1882 of $420,000, and places Custer next to Gilpin in the production of gold.

## DOLORES COUNTY.

This county forms a portion of the San Juan region; is bordered on the north by San Miguel, east by San Juan and La Plata, south by La Plata, and west by the Territory of Utah. The principal mining so far done in this county is in the eastern portion, and is known as the *Pioneer Mining district.*

The chief camp is Rico, in the vicinity of which considerable progress has been made during the past year in the advancement in mining interests. During the spring many important strikes were made, which resulted in a more thorough development of mines, many of which have been or now are in a condition to produce pay mineral. Although the value produced during 1883 is more than double that of 1882, the value during the coming year will probably be greatly in excess of 1883. This is on account of the vast amount of money expended upon improvements and the advantage the miner now possesses in understanding a more economical mode of developing and locating the ore-bodies The formation is somewhat similar to that of Leadville. On Dolores Mountain, south of Rico, is the Newman group of mines, owned by the Marr's Consolidated Mining Company. The group is composed of the Newman, Chestnut, Swansea, Swansea Extension, W. L. Stevens, Parsons, Tip Top, and Ocean Wave, the first five being producers.

The Robert E. Lee runs parallel to the Swansea; is a true fissure vein, varying in width from 6 inches to 2 feet. It is opened by a tunnel, 100 feet from which a small quantity of ore has been taken running 52 ounces silver per ton.

The shaft on the Parole is down 210 feet, and a change of mineral has taken place and is confined within a 20-inch streak of black oxide of copper. Tests on the ore have given 39 ounces in silver and 52 per cent. in lead. A lead test showed 72 per cent. in that mineral, and another returned 80 per cent. The average of the ore may be safely stated at from 40 to 50 ounces in silver and about 60 per cent. in lead.

The Grand Duke Mining Company is working the Orphan Girl, the Forest, and Grand Duke mines, on Dolores Mountain. On the first named a cross-cut is being run through solid iron, which will tap the vein about 70 feet deep in a tunnel 100 feet long. This is the property which sold several tons of iron ore to the Grand View smelter for flux. Two shifts are running the cross-cut. Another cross-cut has just been started at the bottom of a 100-foot shaft in the Forest, which is being driven to intersect the hanging wall, which will probably be cut some time during the coming week. This claim has produced some of the highest-grade ore of the group. An incline tunnel on the Grand Duke is being run and is now in about 120 feet. The Black Hawk, east of Rico, has come to the front as a producer. At the upper tunnel of the mine the ore body is still without any limit. A tunnel of 45 feet and two drifts, aggregating 30 feet, are entirely in mineral. The ore shipped runs 75 ounces. It is a sulphuret, and bears a striking family resemblance to ordinary clay.

The Little Maggie now ranks as a producing mine. The width of the vein cannot now be determined, as the foot wall has not yet been encountered. Eleven feet of solid ore, however, is exposed. The character of the mineral is sulphurets and sand carbonates, the latter occurring in streaks and pockets through the vein. The first-class mineral averages 150 ounces, 5 tons per diem being shipped to the Grand View smelter. This is from the shaft. From the incline above about 2 tons per day are now shipped, which runs from 70 to 75 ounces. The general average of lead, of all the ores, is at present 40 per cent. Twelve men have been working on the vein and have taken out several tons of ore a day.

The Lelia Davis is the property of the Rico Pasadena Mining Company. The same company owns the Minnehaha, McCormac No. 2, Telegraph, Evening Star, Morning Star, Bobtail, and five other claims. The Lelia Davis is the only producer. The ore shown in the shaft is a sand carbonate and black manganese, running about 90 ounces silver per ton. Its development consists of a tunnel 335 feet and a shaft 145 feet. About 40 feet of drifting and raising is all that will be necessary to connect the shaft and tunnel. Drifts are being run on the vein.

The Wabash, that produced considerable at one time, has been idle during the year.

The Pigeon, adjoining the Wabash, is now in good shape for producing. The ore streak is from 10 to 20 inches wide, principally galena, that runs 100 ounces of silver per ton. The developments consist of a shaft 106 feet, a tunnel 138 feet, and a cross-cut 56 feet. The tunnel will be pushed during the winter 200 feet, and as that progresses winzes will be made to connect with levels above.

On Nigger Baby Hill is the property of the Grand View Mining and Milling Company. The Grand View and Phœnix have been worked the most during the year, each mine having produced considerable ore. A tramway 1,500 feet long conveys the ore to the smelter. The mines are well developed, having an aggregate of over 2,300 feet of tunnels, shafts, drifts, and winzes. Among the early locations of the camp are the Grand View, Yellow Jacket, Pelican, Major, Aztec, and Elliott lodes, held under patents from the United States Government. The Grand View has added a large amount to the silver output of Rico. The mill-sites are the Columbia, Aztec, and Elliott lodes. The mines of the company, with one exception, are located on Telescope Mountain, northeast, and near the junction of Silver Creek with the Rio Dolores. The Aztec mine, the exception, is an Expectation Mountain location. Conveying the ore from the mines to the smelter are cars, operating over 1,500 feet of tramway, at the foot of which are extensive ore-bins.

The mines are well developed, having in the aggregate 2,308 feet of tunnels, shafts, drifts, and raises, distributed as follows:

| | Feet. |
|---|---|
| Tunnels | 1,364 |
| Shafts | 334 |
| Drifts | 445 |
| Raises | 165 |
| Total | 2,308 |

So far this season the mines have yielded 1,050 tons of the most desirable ore for smelting to be found in the camp, and during the past year a great deal of development work has been done.

The Cross.—This vein is being developed on a systematic and extensive scale. About 20 tons of ore have been shipped to the Grand View smelter, which was sampled and runs from 82 to 200 ounces, and is contained in a streak of carbonate of lead ore ranging in width from 2 to 12 inches. The workings are operated through a shaft 250 feet in depth, from which drifts are run at various distances. There are 150 feet of drifting from the shaft; two drifts are run at 130 feet down; two more at 160 feet, and one at 230 feet, from which point the shaft is continued down to a total depth of 250 feet. The waste is now hoisted by means of a contrivance invented by Mr. Campbell and first put in use in mines in the Rabbit Ear Range. A day and night shift, however, is now at work on a drift to be run 175 feet to the surface, which will enable the workmen to use a car in getting rid of the waste. The mouth of the drift will strike the surface on the old Hope dump, which has cleared Telescope Mountain of trees from the mine to the Dolores River. Another drift is now under way which will be run to the end line of the Cross location (which is also the side line of the Grand View mine). This drift will be on the vein for a distance of 500 feet, and will give an average of 150 feet of stoping ground to the surface. The working force is now composed of 13 men. The Cross is a patented mine, and was one of the first locations of the camp.

The Puzzle mine, in Horse Gulch, has not been working all the time during the year. Some development has been made; the workings have been joined and now compose one long drift of about 400 feet in length. A new tunnel has been run on the vein about 100 feet; this will be continued, when shafts will be made connecting the upper and lower levels.

The Puzzle Extension is owned by the Santa Clara Milling and Mining Company, and is at present in a condition to produce a quantity of mineral. The developments consist of a shaft 60 feet, from which drifts were run east and west. The east drift is 137 feet long and connects with the Puzzle drift. Only about 50 feet of this distance has been stoped, although much of the distance the workings show good ore. The west drift is 260 feet, and from this portion of the mine most of the ore has been taken. This mine has supplied most of the ore for the Santa Clara mill. New workings to be made at a greater depth during the winter will put the property in the best of condition.

The Johnny Bull, after having been idle for a considerable time, was, during the fall, cleaned out and put in good condition. The ore has been left in the stopes while other developments in the shape of prospect shafts and cross-cuts have been made. The shaft at 120 feet connects with a tunnel that cuts the vein at 236 feet. At the junction is a chamber 12 by 15 feet, from which a drift is run to the northeast 105 feet and one southwest 25 feet, disclosing a good body of ore. Shaft No. 2 is 80 feet, from which a drift 45 feet has been run.

The Rockland, 3,000 feet from the Johnny Bull, shows a vein 5 feet between walls, with a pay-streak 14 inches wide. Mineral is exposed the entire depth of the shaft, which is 122 feet deep, that mill-runs 60 ounces silver per ton.

Adjoining the Johnny Bull is the White Rock, the pay streak being composed of white quartz, carrying gray copper averaging 40 ounces silver per ton, the pay streak averaging 15 inches wide. A tunnel 60 feet cuts the vein at right angles; at the end of this levels are being run each way.

The Omaha, an extension of the Rockford, shows the same character of mineral developments; consists of a shaft 50 feet and tunnel 35 feet that is being pushed to cut the vein.

On the North Fork of Horse Creek is the Rico, that possesses a vein 6 feet between walls and a pay streak of 28 inches. The ore, a black oxide and gray copper, runs 30 ounces silver, 2 ounces gold, and 35 per cent. copper per ton. This mine is being developed by two shafts at present; one shaft is 90 feet deep, and the other, 125 feet from it, is 66 feet. A drift will be run connecting these two shafts at a depth of 100 feet.

On Expectation Mountain the Intra Muros Mining Company own the Little Pittsburg, Mohegan, Blue Bird, and Stranger Claims. On the Little Pittsburg the developments consist of a tunnel 300 feet long and a shaft 225 feet deep on the Aztec Gulch side of the mountain. From the opposite side another tunnel 100 feet is run and a shaft sunk 40 feet. The 300-foot tunnel is in lime and porphyry all the way. On the Mohegan is a cross-cut tunnel 160 feet and a drift on the vein of 134 feet. The mineral is scattered, assaying $110 per ton.

The Clyde produces an iron ore, running but a small amount in silver. A cross-cut is being run to cut the vein at a depth of 150 feet.

The Bancroft, located on the eastern slope of Expectation Mountain, is being developed by a cross-cut 80 feet, and an incline run on the vein 100 feet. The width of the vein is 5 feet, with pay streak of over 2 feet. Character of ore is sulphate of lead, averaging 80 ounces silver per ton.

The Flying Fish has a vein, 12 feet of quartz that runs well in gold and silver, but new developments will have to be made, as nearly one-half of the 200-foot tunnel has caved in.

The Shamrock vein is 15 feet, carrying galena that assays 38 ounces silver and 56 per cent. lead. The ore is scattered and will require concentrating. The property at present,is developed by two tunnels, No. 1 being 75 feet; No. 2 is 30 feet, with a cross cut 20 feet.

On Elliott Mountain the Wildebrand Mining Company are pushing development on their claims, the Lucky Boy and Eliza Jane. A cross-cut tunnel is being run to intersect the veins. The Eliza Jane, discovered in 1880, has a 50-foot shaft, sunk on the adit about 15 feet. It shows a pay streak ranging from 4 feet to 6 inches.

In Silver Creek are the South Park and Ella D. mines, that have come to the front as producers during the year.

The South Park, since it became the property of its present owners, has been the cause of considerable excitement around Rico on account of the numerous and rich strikes.

About 200 feet of tunnel was already run at the time the property was bonded. On June 1, the day the property changed hands. at the end of a 300-foot tunnel, ore was found in small quantities. A few feet further the character of the ore changed in appearance, and but a small amount of work was then required to disclose a large body of manganese ore, which mill-runs 350 ounces silver per ton without sorting. No blasting was necessary in the extraction of this ore, as it was so soft that a knife cuts it readily. Developments continued, when, during the latter part of June, a streak of galena was exposed in the west drift that widened into 4 feet in width. Again in August pockets of wire silver were found in the west drift, in a body of honey-comb quartz. Again in October the miners struck a new body of mineral, differing considerably from anything heretofore found in the mine; this was thin layers of almost pure silver, running through a body of sulphurets, which are from 2 to 6 inches wide, near the boundary line of the Ella D. property Developments now consist of 150 feet of levels, and the tunnel was driven to 430 feet in length. A shaft will be sunk on the line of the Ella D. and South Park for the purpose of ventilation.

The ore of the South Park is slightly refractory and not a desirable smelting ore, except the galena deposits, which can be easily sorted out. Water and bad air have done much to retard the working of the mine, but with the new machinery lately placed all these inconveniences may be obviated.

The Ella D., the claim next to the South Park, is worked through a shaft. At the depth of 74 feet a drift was run that disclosed the black manganese found in the South Park; in fact, in all the workings of this vein the character is similar, the richness the same as at the corresponding depth of its neighbor.

On Democrat Mountain, on the West Dolores, near the town of Bowen, the Little Emma has been producing some ore, although the developments are but limited, there being one tunnel of 40 feet and another 25 feet. The ore is found in a quartz gangue, averaging 200 ounces silver and 1 ounce gold.

The Little Susie, near the Little Emma, is worked by a shaft 65 feet deep; at the bottom drifts are run each way 50 feet, disclosing considerable mineral. The Little Susie is ths property of the Lone Cone Mining Company.

The Little Wonder, below the Little Susie, is worked by a cross-cut 110 feet. The vein is 3 feet; mineral streak 18 inches of quartz, carrying 40 ounces silver and 1 ounce gold.

The Dolores Valley Mining Company own eighty-four claims in the vicinity of Rico, some of which show a good class and quantity of mineral; yet none of them have produced bullion during the year.

The Dolores News estimates the production of this county for 1883 to have been as follows:

| | |
|---|---|
| Grand View smelter | $135,000 |
| Santa Clara Milling Company | 61,000 |
| Rico Reduction Company | 12,000 |
| Ores not treated in Rico | 75,000 |
| Total | 283,000 |

The Rico News makes the following estimates of the production of this county for 1883:

| | |
|---|---|
| Grand View smelter | $135,000 |
| Santa Clara Milling Company | 61,000 |
| Rico Reduction Company | 12,000 |
| Ores not treated in Rico | 75,000 |
| Total | 283,000 |
| Product of 1883 | 283,000 |
| Product of 1882 | 125,000 |
| Differences in favor of 1883 | 158,000 |

I have placed the production for 1883 at gold, $5,000; silver, $250,000; total, $255,000.

The value of the silver produced in 1883 is more than double that of 1882.

## EAGLE COUNTY.

Eagle County was formerly a part of Summit, and embraces what were known as *Eagle River* and *Holy Cross* mining districts. It is bounded on the east by Summit, south by Lake and Pitkin, west by Garfield, and north by Garfield and Routt. The chief camp is Red Cliff, in the vicinity of which are the largest producers in the county, viz, the Eagle Bird Group, Belden, Clinton, Little Chief, Crown Point, Spirit, King Fisher, Discovery, Silver Age, and a few minor properties. These are located on Battle Mountain, while the only producer on Horn Silver Mountain during 1883 was the Horn Silver mine. In the vicinity of Holy Cross and Taylor so much experimenting has been done that the production has fallen far short of what it should have been, while in the other camps in this county nothing beyond the necessary assessments have been accomplished. Several experienced and successful investors in auriferous sulphuret mines, who have recently visited the Holy Cross district, say that in a few years this section will produce in value more than that of Battle Mountain. The veins are similar to those of Gilpin County, strong and well-defined fissures. Every ton of vein filling carries a goodly amount of pay in gold.

Referring again to Battle Mountain. At the commencement of the year the mines were all comparatively inactive. Developments were being quietly pushed, while shipments were light. This state of affairs lasted until July, when the shipments fairly began, and lasted until October, when, on account of the fall in the price of lead, a number of the most prominent producers curtailed their weekly shipments, preferring to allow their ore to remain in the underground workings until more favorable prices could be obtained.

The Belden, located in 1879, consists of the Belden, Mamie, R. L. R., and 57 feet of the Cora. This is one of the best timbered mines on Battle Mountain. The tunnel, which is 700 feet, passes through ore-bodies measuring from 10 to 24½ feet in thickness. The ore is blocked out in large blocks about 40 feet square, and in places 24½ feet high. The company are now putting in a Huson or wire tramway from the property to the railroad, a distance of 1,300 feet. Work for the production of ore has not been pushed, but 3,802 tons have been shipped during the year. This averaged 42 per cent. in lead, 8 ounces in silver, and one-tenth ounce in gold; or 1,294.44 tons of lead, 24,656 ounces of silver, and 308.2 ounces of gold.

Combined Discovery and Silver Age.—These two properties represent the exploitation of the quartzite. They are on the opposite slopes of Rock Creek, and have different owners. Only a small force has been at work on either claim, and the output, though small in quantity, is high grade in quality. From the Discovery 217 tons of mineral returned 62.93 tons of lead and 11,064 ounces silver; or lead $5,160.26, silver $12,170.40. The Age produced 57 tons of ore which gave 17.10 tons of lead and 2,976 ounces silver; or lead $1,402.20, silver $3,273.60.

The Crown Point and Senator, situated on the upper or line contact, were located in 1879. On the Crown Point there is a well-timbered tunnel 165 feet, from which there is an incline running down on the contact 150 feet, and carrying mineral all the way. This incline is being worked with a Baby hoister, located under ground and at the end of the 165-foot tunnel. A tunnel is now being driven on the Senator to connect with the incline, through which the mineral will be brought to the surface. The workings of this property are mostly under the mineral. No mine in the camp has come to the front with such rapid strides as this. For two years it was allowed to lie idle. In June the present owners got possession of the property, since which time it has been put in excellent condition. During the past three months a magnificent body of ore has been brought to light. From present indications in another year this will be the leading property on the Eagle. Its production foots up 3,078 net tons, which returned 38 per cent. of lead, 11 ounces of silver, and two-tenths of gold per ton; or 1,169.64 tons of lead, 33,858 ounces silver, 615.6 ounces gold.

The Clinton Group.—This group of mines, composed of the Clinton, Florence, Cleopatra, and Prince claims, was purchased and consolidated in November by a syndicate composed of Philadelphians. The frontage on the contact embraces a width of 930 feet, and 1,500 feet into Battle Mountain. Each claim is well opened up and all show mineral; the main incline on the Clinton is down 750 feet, the branch incline into the Cleopatra is down 650 feet. Besides these the Cleopatra has an incline from the surface of 125 feet, which has exposed seams of handsome carbonates. The Prince is only a fraction of a claim 30 feet in width. It contains a distinct ore-body from the others that will prove a bonanza when more thoroughly opened up. Up to the present time only one claim of this group has been worked to any extent. The yield for 1883 amounts to 1,715 tons, which averaged 35 per cent. lead, 15 ounces silver, and two one-half tenths gold; or 600.25 tons of lead, 25,725 ounces of silver, and 428.75 ounces of gold. This was the gross yield in reality of six months' work, as it has been idle half the time the past year. This was produced from 1,600 tons of ore. From these data it will be seen the mineral from here has averaged a fraction over 15 ounces in silver to the ton, which is a most flattering comparison with the yield of the best carbonate mine of the camp a year ago.

Eagle Bird Consolidated Mining Company.—The property known as the Silver Wave or Eagle Bird consists of twenty-five patented claims, among which are some of the best producing mines in the camp. They are the Silver Wave, Eagle Bird, Little Nell, Ida Kruse, Bertha, Blake, Longfellow, Mexican Maid, May Queen, Indian Girl, Cleveland, Little Topsy, Black Iron, Morgan, Jennie Lind, Bullion, Little Barney, Rob Roy, Little Ella, Battle Mountain, Little Chicago Bird, Silver, and Aspen. Among these claims which are now being worked are the Silver Wave, Eagle Bird, Indian Girl, May Queen, Cleveland, and Black Iron. Upon the Silver Wave and Eagle Bird, which are being worked together. About $50,000 have been expended and 2,000 feet of work done. Mr. James Pippin, a man of vast mining experience, has had the entire management of the company's property since the 1st of August, and has done much to restore the property to its present paying condition. In the Silver Wave there are large bodies of wet, loose sand mixed with carbonates, making it very hard to get timbers strong enough to hold it.

In driving a drift the main ore-body was opened where it measured 18 feet of solid mineral, composed of sand and hard carbonates. A shipment of two car-loads from the May Queen returned $533 net, or $26.65 per ton; two car-loads from the Black Iron, $599.50 net, or $29.77 per ton. The average amount of silver from several car-loads from the Indian Girl was 31 ounces. This claim contains a very fine-ore body, and is looked upon as one of the most promising mines in the camp. On the Cleveland there is an incline 500 feet, nearly all in black iron, and way below the mineral. There have been 1,200 tons of ore shipped from the Cleveland, averaging 14 ounces in silver, 60 per cent. in lead, and carrying some gold. There are 216 feet of side drifts in the Cleveland, one of which leads into a large cave 75 feet across, out of which considerable rich mineral has been taken. The average shipment from the company's entire property is about fifty cars per month. The ore is conveyed to the railroad over a tramway 1,100 feet, running from the Silver Wave. Up to the month of November this company was the largest producer in Eagle County, but during that month, owing to litigation, the mines were closed.

During the year 1883 the Black Iron has produced 800 net tons, which averaged 54 per cent. in lead, 10 ounces in silver, and one-tenth ounce in gold. This foots up 432 tons of lead, 8,000 ounces of silver, and 80 ounces of gold. The production of the Cleveland was 1,700 net tons of 48 per cent. lead, and 12 ounces in silver, which gives 816 tons of lead and 20,400 ounces of silver. The Eagle Bird Group furnished 2,272 net tons, which averaged 32 per cent. lead, and 7½ ounces in silver; or 727.04 tons of lead and 17,040 ounces of silver. A portion of this ore returned one tenth of an ounce in gold, amounting in all to 18 ounces. Lumping these amounts together we have 1,969.04 tons of lead, 45,440 ounces of silver, and 98 ounces of gold.

The Great Eastern is located about half way between Red Cliff and Rock Creek, and has a tunnel 120 feet. This property is somewhat pockty, carrying considerable iron, sand carbonates, galena, and some gold. It is generally low-grade mineral, and is higher on the contact than the other mines. It has shipped 125 tons of ore that averaged 28 ounces silver and 55 per cent. lead.

The Little Chief, situated on the lime contact, was located in 1879, and is now owned by the American Mining and Smelting Company of Leadville. This property shut down in the spring, on account of the large flow of water, and remained unproductive until the latter part of August. During the time the property was idle a new, hundred horsepower steel tubular boiler and a double cylinder engine, of equal power, were built and placed in position. The underground improvements consist of 800 feet of an incline, with side drifts, upraises, and stopes of 1,000 feet, making, in all, 1,800 feet of workings. During the year 3,700 tons have been shipped, averaging 38 per cent. lead, 11½ ounces in silver and two-tenths ounce in gold; or, 1,406 tons of lead, 42,550 ounces of silver and 740 ounces of gold.

Spirit and Kingfisher.—These two adjoining mines have yielded 2,950 tons net, which returned 40 per cent. lead, 11 ounces silver, and one and a half tenths gold to the ton. The latter has only aimed to extract sufficient mineral to meet the expenses of development, and its output figures 50 tons a month, while the Spirit has of late been more energetically worked. Their metallic contribution amounts to: Lead, 1,180 tons; silver, 32,450 ounces; and gold, 442.5 ounces.

The Kingfisher, which is the first property on Battle Mountain in which mineral was discovered, is on the lime contact, and was located in 1879. It consists of five claims—the Kingfisher, Little Ollie, Belle, and Iron Mask, all of which contain large bodies of mineral. The main workings are on the Kingfisher lode, and consist of a 70-foot shaft, from which an incline is run 400 feet along the contact and into large bodies of mineral. Shipments from this property average $35 per ton, net, and consist of sand carbonates, lead, and gold.

The Spirit, lying east of the Kingfisher property, was located in 1880 by Messrs. Williamson & Murdy. For the past year it has been successfully worked. It has an incline on the contact 100 feet, and three side drifts 100 feet, 75 feet and 90 feet, respectively, with large bodies of mineral in all of them.

The Uncle Sam mine, on the lower end of Battle Mountain, is in the quartzite on the west side of Rock Creek and on the north side of Eagle River. This property was located in 1881. It is now showing some very fine mineral and will be opened up for shipment.

Horn Silver.—Though the Horn Silver does not belong to the Battle Mountain Group, it is a portion of the camp, and hence is included in this list. During the year it is the only property on Horn Silver or Greiner Mountain that has produced any ore. It has only been operated since the middle of September, and most of the time has been devoted to putting the mine in shape for economical working. Six car-loads have been shipped, which returned 3,657 ounces in silver.

*Holy Cross district.*—The Gold Park Mining and Milling Company is probably the best developed and equipped property in this district, consisting of the Calumet, Little Mollie, Pelican, and Grand Trunk mines, and the Grand View tunnel. The developments consist of over 400 feet of shafting, and in tunnels, drifts, &c., over 1,000 feet. A good plant is also owned by this company, consisting of a 25-stamp mill, crusher, roller, concentrator, and an 80 horse-power engine, sufficient to run these. The veins are wide and the filling auriferous, averaging from $30 to $80 per ton. This company, not meeting with success, leased their mines in August, and the lessees extracted considerable bullion during the first four months. Experimental and test runs have consumed much time.

The Great Eastern mine, on French Mountain, is developed by tunnel 90 feet. Considerable ore has been extracted, running from 1½ ounces to 4 ounces of gold per ton, which will be shipped during the spring.

The Great Western, adjoining the Great Eastern, has been considerably developed, and has produced a large amount of ore, but a small portion of which has been treated at the 10-stamp mill owned by the lessees of the mine. The shaft is down about 85 feet, with drifts at about 60 feet. During 1883 but a small amount of stoping was done. The ore is worth about $60 per ton, and the pay streak is about 24 inches in width.

The Kansas Chief, in Fancy Gulch, is another property that will be a large producer during 1884. The claim has a vein 30 feet wide, outcropping in the bed of Fancy Creek, and is as plainly outlined as can be imagined. Shafts and drifts along the entire length of the vein have proved the strength of the deposit. A shaft 50 feet deep has exposed at the bottom 30 feet of fine ore.

On Buckeye Hill, north of Tennessee Pass, and about half a mile from Taylor P. O., is the Buckeye Mining Company. This company's property is composed of three claims, viz, Henry Dawson, Iron Queen, and Golden King, each being 75 by 1,500 feet. These veins are from 8 to 30 feet in width, the filling being composed of quartz carrying from 1 to 3 ounces gold, and about 2 to 3 ounces silver. The ore is free milling, but on account of the gold being too fine to be caught, the property was not worked to its full extent. Developments of this property consist of a shaft 170 feet, an incline 168 feet, and six drifts, amounting to 160 feet. New machinery has been purchased by the company by which the flour gold can be saved.

The Mining Record of January 19, 1884, gives the production of this county for the year as follows:

| Name of mine. | Tons ore. | Tons lead. | Ounces silver. | Ounces gold. | Total value. |
|---|---|---|---|---|---|
| Black Iron | 800 | 432 | 8,000 | 80 | $45,824 |
| Cleveland | 1,700 | 816 | 20,400 | | 89,352 |
| Eagle Bird | 2,272 | 727 | 17,040 | 18 | 78,721 |
| Belden | 3,082 | 1,294 | 24,656 | 308 | 139,429 |
| Clinton | 1,715 | 600 | 25,752 | 428 | 86,093 |
| Little Chief | 3,700 | 1,406 | 42,550 | 740 | 176,897 |
| Crown Point | 3,078 | 1,169 | 33,858 | 615 | 145,466 |
| Spirit and Kingfisher | 2,950 | 1,180 | 32,450 | 442 | 141,305 |
| Other properties | 230 | 110 | 5,655 | 14 | 15,546 |
| Combined Discovery | 217 | 63 | 11,064 | | 17,331 |
| Silver Age | 57 | 71 | 2,976 | | 4,676 |
| Horn Silver | 58 | | 3,657 | | 4,023 |
| Total | 19,859 | 7,868 | 228,058 | 2,647 | 944,663 |

In this table no account is taken of the ore shipped from the Highland Mary, Huron, Washington, or other fissures in the cañon. These mines have all contributed from 10 to 20 tons each, or even more, to this yield. The Highland Mary for several months has been worked under a lease and considerable mineral shipped of which no accurate figures could be obtained. This mineral is of high grade, running from $150 to $600 per ton. Besides these figures the Silurian has sent away a few tons of valuable truck. To put the output of these properties at $12,000 will not be overreaching the truth. From the entire camp this would give the round sum of $956,663.

From all the data that I have been able to obtain in regard to the production of the mines of this county during the calendar year 1883, I have placed it at gold, $70,000; silver, $300,000; total, $370,000.

## FREMONT COUNTY.

This county can as yet hardly be ranked as a producer of the precious metals, and yet they are known to exist within its borders, and considerable development work has been done on which are believed to be good claims. Its mines contain mostly the baser metals.

The Quaker City has a good body of mineral exposed, composed principally of galena, carbonates of lead and iron.

The Red Bird is a large, well-defined lode of quartz, carrying brittle silver. The ore is copper pyrites, glance, and black oxides. Owing to the accumulation of water, work was suspended, but a new find is reported, and it is expected that work will soon be resumed.

The Cliff and Wade Hampton lodes are being developed by their owners. These lodes are in lime formation and the ores are silver contained in sulphurets, oxides, and silver glance.

On the same belt is the property of the Southwestern Mining and Milling Company, a group of several claims now being developed. They are good lodes of argentiferous galena, carrying some gold. This company has also an iron carbonate lode now exhibiting more than 12 feet of carbonate ore of fair quality. It is a contact of fissure between lime and porphyry.

On the same lode is the Buckhorn iron mine. The walls of this mine are of lime and porphyry, the ore iron carrying silver.

The Pride of the West, on the same belt, carries a high grade of copper ore, rich in sulphurets. A tunnel has been run about 150 feet towards the main ore-body.

The Rose has a tunnel of 200 feet and a shaft of 60 feet. The ore runs 100 ounces silver, and the ore-body seems to increase in extent as the work of development proceeds. The owners have been shipping about 3 tons a week.

The production of this county for 1883 was about $20,000 in silver.

## GILPIN COUNTY.

Gilpin County extends from the junction of North and South Clear Creeks westward to the Snowy Range; Boulder County borders it on the north, Jefferson on the east, Clear Creek on the south, and Grand on the west. Granite occupies most of the territory where the mineral veins are found. Some veins lie between granite and gneiss; hornblende occurs in dikes, and there are occasional patches of porphyry. There are two main systems of lodes in the gold belt, the more numerous having an east and west direction, and the others extending almost northeast and southwest. Of the former class are the Bobtail, Kansas, Gardener, California; and of the latter, the Gregory, Bates, Buell, and Fisk. The veins termed gold-bearing are composed of copper, iron pyrites, or sulphurets carrying gold and a less value in silver. The gangue includes quartz, feldspar, crystals, and other matter. Many veins include galena, some in large quantities. The vein matter is usually decomposed near the surface and down to a depth of 60 or 70 feet. This is called surface quartz, and from this the gold is more freely extracted than the vein material at a greater depth. The main portion of the gold-bearing veins is located in an area of less than 4 miles long by 2 wide, and in the midst of this, in an almost continuous line, are the cities of Black Hawk, Central, and Nevadaville; but many valuable gold lodes and all the silver district are situated outside of this. Rising abruptly from the dividing ravines and city streets are a number of lofty hills, around which the mines are located. From Black Hawk, westward to Nevadaville, are Bates, Bobtail, Gregory, Mammoth, Central City, Casto, Grinnell, and Quartz Hills, which, with their intervening gulches, are intersected by numberless metalliferous veins or lodes, the source of the golden millions of the past and present.

What is termed the silver belt extends to the north and northwest of Black Hawk, across North Clear Creek, from York Gulch and Wide Awake to Dory Hill. The first discoveries were made in this locality in June and July, 1878, since which time about $1,000,000 in silver has been produced.

For twenty-three years Gilpin has been the leading gold district of Colorado. The production has been going on ever since the arrival of the pioneers in 1859.

The following statement of the production of this county is from Hossett's History of Colorado. The figures for the years previous to 1868 are estimates, the value of gold and silver not separate.

| | | | |
|---|---|---|---|
| 1859 | $250,000 | 1873 | $1,340,502 |
| 1860 | 900,000 | 1874 | 1,531,863 |
| 1861 | 750,000 | 1875 | 1,533,909 |
| 1862 | 1,200,000 | 1876 | 2,105,544 |
| 1863 | 1,600,000 | 1877 | 2,208,037 |
| 1864 | 1,800.000 | 1878 | 2,280,871 |
| 1865 | 1,500,000 | 1879 | 2,625,750 |
| 1866 | 750,000 | 1880 | 2,680,090 |
| 1867 | 1,000,000 | 1881 | 2,150,700 |
| 1868 | 1,305,000 | 1882 | 2,006,516 |
| 1869 | 1,680,000 | 1883 | |
| 1870 | 1,552,000 | | |
| 1871 | 1,400,000 | Total | $37,540,071 |
| 1872 | 1,389,289 | | |

Much of the activity that has kept the mines of Gilpin County bravely to the front during the past few years, when newer camps were springing up on all sides, claiming the public notice, is attributable solely to the fact that the settlers of that locality had confidence in the future of that section. Capital was being directed towards other quarters, and the business men saw the necessity of taking hold of their mines themselves. They did so, and the result was that a general tone of healthfulness and prosperity was built up.

The Central City Register Call furnishes the following in regard to the number of stamp-mills and their capacity in operation in Gilpin County:

| | Number of stamps. |
|---|---|
| Denver (limited), Nevadaville | 52 |
| Whitcomb Mill Company, Nevadaville | 25 |
| Rhu, Nevadaville | 6 |
| Kipp & Buell, Central | 50 |
| United Gregory, Central | 50 |
| New York and Colorado, Central | 40 |
| Bobtail Mining Company, Black Hawk | 125 |
| Empire Mining Company, Black Hawk | 25 |
| Kimber Mining Company, Black Hawk | 35 |
| Bostwick Mining Company, Black Hawk | 25 |
| Fullerton Mining Company, Black Hawk | 40 |
| Midas Mining Company, Black Hawk | 30 |
| Hidden Treasure Mining Company, Black Hawk | 50 |
| Humphrey Mining Company, Black Hawk | 20 |
| Fullerton (upper mill), Black Hawk | 37 |
| Wheeler, Black Hawk | 25 |
| California, Black Hawk | 50 |
| New York, Black Hawk | 75 |
| Randolph, Black Hawk | 50 |
| Cashier, Black Hawk | 35 |
| Rollins, Gold Dirt | 16 |
| Daisy, Gold Dirt | 15 |
| Russell, Russell Gulch | 20 |
| Pewabic, Russell Gulch | 25 |
| Freese, Lump Gulch | 15 |
| Pease, Peck Gulch | 10 |
| Total | 879 |

Those that have been during the year or are now running are the following:

| | Number of stamps. |
|---|---|
| Denver (limited), Nevadaville | 40 |
| Rhu, Nevadaville | 6 |
| United Gregory, Central | 50 |

| | Number of stamps. |
|---|---|
| Bobtail, Black Hawk | 75 |
| Cashier, Black Hawk | 35 |
| Humphrey, Black Hawk | 20 |
| Randolph, Black Hawk | 50 |
| New York, Black Hawk | 75 |
| California, Black Hawk | 50 |
| Empire, Black Hawk | 25 |
| Kimber, Black Hawk | 35 |
| Bostwick, Black Hawk | 25 |
| Fullerton, Black Hawk | 40 |
| Hidden Treasure, Black Hawk | 50 |
| Rollins, Gold Dirt | 16 |
| Daisy, Gold Dirt | 15 |
| Pewabic, Russell | 25 |
| Total | 632 |

In regard to the number of car-loads of ore and tailings shipped from Black Hawk in 1883, the Register Call says:

"Through the courtesy of Mr. C. H. Sprague, the agent of the Colorado Central Railroad at Black Hawk, we are enabled to give the number of car loads of ore and tailings shipped from that point to the smelters and sampling works at Golden, Denver, and Argo. A large quantity of the product is purchased in Denver by the Pueblo Works, Grant Smelting Company, and the agents of the Omaha and other smelting establishments, the returns from which we are unable to present, and which will have to be estimated in the recapitulation. The figures include the shipments up to the 27th of December, and will be found in the following table:

| Months. | Ore. | Tailings. |
|---|---|---|
| January | 97 | 80 |
| February | 81 | 103 |
| March | 115 | 163 |
| April | 100 | 140 |
| May | 131 | 162 |
| June | 118 | 135 |
| July | 115 | 108 |
| August | 128 | 115 |
| September | 118 | 122 |
| October | 134 | 155 |
| November | 126 | 164 |
| December | 97 | 84 |
| Total | 1,360 | 1,531 |

"Allowing 10 tons to the car-load, it will readily be seen that there were shipped 28,910 tons of smelting ore, an average of nearly 2,500 tons per month."

On Bobtail Hill is the property of the Bobtail Consolidated Mining Company, well known throughout the country, as one of the largest and steadiest producers.

The following is from the Register Call:

### "BOBTAIL MINING COMPANY.

"Mr. A. N. Rogers, the superintendent and general manager of the Bobtail tunnel workings, furnishes the following brief synopsis of the development work for 1883: Drifts, 578½ feet; winzes, 127½ feet; a total of 715 feet. During the same period a cross-cut tunnel north has been driven 900 feet to intersect the Kip mine, which has been worked under the management of Mr. Rogers, and which will be worked by levels, when the vein is reached, east and west of the cross-cut. This will facilitate the handling and transportation of the ore to the stamp-mill and sampling works, or smelter. It will also prove very advantageous in another respect, that of back stoping, as the depth at which the vein will be reached will open a large amount of ground not yet developed. During 1883 an average of 40 miners have been employed on tribute work. At the 125-stamp mill of the company in Black Hawk 2,033 cords of ore have been crushed, an average of sixty-five stamps having been kept running steadily. The production of the company from all sources for the year was $109,000.

"The conveniences afforded in the tunnel for extracting the ore and tramming it to the stamp-mill are such, that every expense is kept as closely as it is possible to do so. Every detail is so systematized that the cost of mining and milling is readily obtained.

"The production is apparently light as compared with former years, but when the fact is considered that the principal work accomplished has been in exploring new ground, the showing is not unfavorable. Nothing has been done below the tunnel level, a little less than 500 feet. Heretofore the Bobtail Company has been at great expense in handling the water from the Bobtail and tributary veins, and failing in receiving a fair compensation for such service, they hoisted their pumps up to the tunnel-level about a year or more ago, and since that time they have been quietly prospecting on the veins owned by them and near the Bobtail."

The running lode on Bobtail Hill and within the city limits of Black Hawk was worked about 8 months during the year, having shut down on account of the death of its owner. The property is 6,900 feet long by 150 wide, there being between 3,000 and 4,000 feet of development-work, consisting of shafts, tunnels, and levels, all in good working order. In addition to 4,000 to 5,000 tons of smelting and concentrating ore the stopes show large bodies of ore in reserve. Connected with the running lode is a 20-stamp mill and a concentrator of a capacity of 50 tons per day, in addition to a number of ore, dwelling, shaft, and engine houses.

The Cotton mine, near the Bobtail vein, consists of three veins, the Cotton, Big Cotton, and East Cotton, aggregating 3,850 linear feet. The principal portion of the work has been done on the Cotton, where a main shaft is 230 feet deep, which contains three levels, the largest being 300 feet. The smelting ore averages $150 per ton; the milling ore, 5 ounces gold per cord. This property recently changed hands, and work is being energetically pushed.

The Arctic has not been worked during 1883. The developments consist of a shaft 450 feet; at the bottom, drifts were run east 150 and west 100 feet, disclosing large bodies of ore.

On Central City Hill the German tunnel, driven to catch the lodes on that hill, has been idle for some time past, but during December lessees have cleaned it out, placed new timbers where required, and are now engaged in driving the tunnel, which at present is 700 feet long, to a point under the working shaft of the Maine lode, where there is an upraise from the tunnel, and by sinking the shaft connection will be made.

The main lode is developed at present by a shaft 175 feet deep and three levels, one at a depth of 70 feet and two at the bottom of the shaft.

The Galena lode, owned by the Palius Mining Company, lies northwest of the main lode. The main shaft is 400 feet deep, with about

600 feet of levels. A cross-cut was recently driven from the bottom of this shaft 40 feet to the north, cutting the Burgher lode, upon which levels were run east and west 50 feet.

The Bull of the Woods, near the Galena, is being developed with good results, the pay streak having widened from 2 inches to 16 inches.

Of the Bonanza and Union tunnel the Register Call has the following:

"One of the largest mining enterprises in the county is that of the Bonanza and Union Tunnel and Mining Company, a New York corporation, with a capital stock of $2,000,000. This enterprise embraces the tunneling of Maryland Mountain on the north, and Bates or Casto Hill on the south, and is projected to traverse a large section of the mineral belt of veins carrying precious metals in this immediate vicinity. The Bonanza and Union tunnels both debouch in Chase Gulch, and thus afford a ready facility for handling the ores mined from all the veins crossed. The company owns extensive dumping ground and mill-sites, and have all the appurtenances, machinery, and appliances for the accomplishment of a mammoth undertaking. A number of our most valuable gold and silver veins are known to extend in their general trend through the section of country selected and surveyed for the course of these tunnels, and while several rich and valuable strikes have already been made, it is confidently expected that as the work of extension of these tunnels progresses still richer finds will continue to be met with, and these tunnels will thus become the outlets and highways for the transport of ores from a number of our richest mines. Considerable progress has been made in developing veins already crossed by the tunnels. The Maryland, Bonnell, Hyde, Kentucky, and McCorkle, all large and well defined veins crossing the Bonanza tunnel, will, in general, average over 300 feet of development, and show up an extent of mineral deposit from which hundreds of tons of vein matter can readily be taken. Half a dozen other veins of lesser note have been pushed forward on either side of this tunnel to the distance, on an average, of 50 to 75 feet, and show up well. The Bonanza tunnel has reached a distance of 1,130 feet and the Union tunnel 645 feet in from Chase Gulch. We noticed a number of good veins crossing the Union tunnel, among others, the White Spar, Stull, the Maryland, Kettle, Como, and Swede, extending in drifts on the tunnel level from 45 to 239 feet in length on either side of the tunnel. The tunnels proper have been run by Ingersoll air-drills, Clayton compressors, and in workmanship and all appliances are models for the convenient and expeditious handling of ores. At present miners are working in the breast of both enterprises, by hand power. It is expected that power drills will be used the coming month. The following statement gives the present amount of development in each tunnel up to date:

BONANZA TUNNEL.

| | Feet in length. |
|---|---|
| Maryland vein east | 557 |
| Maryland vein west | 56 |
| Bonnell vein east | 27 |
| Bonnell vein west | 100 |
| Flood vein east | 26 |
| Hyde vein east | 99 |
| Hyde vein west | 210 |
| Kentucky vein east | 228 |
| Kentucky vein west | 29 |
| McCorkle vein east | 274 |
| McCorkle vein west | 70 |
| Cornish vein east | 45 |
| Cornish vein west | 29 |

UNION TUNNEL.

| | Feet in length. |
|---|---|
| White Star vein west | 26 |
| Stull vein west | 39 |
| Maryland vein west | 164 |
| Maryland vein east | 27 |
| Kettle vein west | 239 |
| Kettle vein east | 29 |
| Como vein west | 70 |
| Swede vein west | 45 |

"On the dumps near the entrance to the Bonanza tunnel the company have piled up the ore removed in development work, which assays all the way from $35 to $287 per ton, the average being about $40 per ton for the clear mineral. The same can be said of the Union tunnel ore."

*Nevada district.*—The Gunnell Consolidated Mining Company, after considerable litigation, now have full control and ownership of 7,055 linear feet of desirable mining property. The following is a list of the claims, with the number of linear feet on each:

| | Feet. |
|---|---|
| Main Gunnell | 2,855 |
| Gunnell No. 2 | 1,500 |
| Wheeler | 1,500 |
| Marine | 600 |
| Hattie | 600 |
| Total | 7,055 |

All these are worked through the levels of the Gunnell proper. Prior to the consolidation these veins were worked in short properties by different parties, the estimated amount produced up to 1874 being $2,500,000. No sinking has been done in the pump shaft, which is 1,150 feet deep, since 1882, the pump having been moved to the 800-foot level, where most of the work during 1883 has been done.

The Grand Army shaft, west of the pump shaft, has been sunk 200 feet, making its depth 1,000 feet, at which point levels have been driven east and west. The surface improvements are of the most substantial and commodious stone buildings, inclosing powerful plants of machinery.

The Mountain Lion, on the south side of Gregory Gulch, has been cleaned out, and the shaft is now being sunk. At present it is 90 feet, at which depth drifts are run 30 feet east and west. The crevice is well defined and carries quite a vein of mineral.

The United Gregory Gold Mining Company owns 1,719 feet on the Gregory lode and 517 feet on the Briggs lode, Gregory mining district, Gilpin County, Colorado. The property is situated in Gregory Gulch, near the line dividing Black Hawk and Central City. This lode was the origin of "Gregory Diggings."

In a southerly direction are the Bobtail and Fisk lodes; northerly, the Bates and Leavitt. Located upon the lode are two working shafts; the Pump shaft 880 feet deep, with 14-inch Cornish pump and hoisting gear, and the Briggs shaft 915 feet deep, with hoisting gear. Adjoining the Briggs shaft is the company 50-stamp mill. During the past three years the principal work done has been westerly from Pump shaft, through six working levels, aggregating 4,100 feet in length. The lode has been worked out an average of 445 feet from surface. The method of working is to run levels and stope overhand; the broken ore is trammed to the shaft and dumped into "plates" with chutes, from which it passes into buckets and is hoisted to the surface. The ore is quartz, with pyrites of iron and copper, carrying gold and silver. The mill ore averages $7 per ton; smelting ore, $75 per ton. It is estimated the property has produced $8,000,000, and it is hoped that many millions remain to be extracted. Pumping has been suspended, owing to the heavy expense, as the other mines in the vicinity are not drained.

The Prize-Senderberg, southwest of the Gunnell, has been worked extensively during the past year. The deepest workings are 700 feet; the aggregate in levels are about 300 feet.

Mackey-Burroughs.—This portion of the Burroughs lode has been worked under lease for several years. The shaft is 700 feet deep. No sinking has been done this year, the workings being accomplished in drifting and stoping. The 700-foot east level has been driven 120 feet, the 600-foot east 120 feet, the 500-foot east 200 feet, the 400-foot east 275 feet, and the 300-foot level 30 feet east—a total of 745 feet of drifting for the year. The average number of miners employed is 25. The stamp mill dirt yields 3 ounces gold per cord, and the smelting iron nets $50 per ton.

The La Crosse-Burroughs, west of the Mackey-Burroughs, is also worked under lease. The main shaft is 820 feet, 100 feet of which was sunk since January 1, 1882. Since that date 300 feet of levels have been run, and a 60-foot winze sunk to connect the 400-foot with the 500-foot level. The output of smelting ore per month is about 50 tons, the crevice affording but a small amount of mill dirt, and that of a low grade. The smelting iron averages $50 per ton net.

The same pool are operating the Pease property on the Kansas lode, north of the Burroughs and on the northerly slope of Quartz hill. The Kansas vein is a heavy pitcher to the south, while the Burroughs pitches to the north. It is estimated that when the main shaft on the latter shall have attained a depth of 1,000 or 1,100 feet both veins will come together. At present writing the pool are crossing from the Kansas to the Monroe vein, with a view to starting pay. Since striking up on the Kansas 350 feet of drifting has been done, and a winze sunk from the 300 foot to the 350-foot level. They have a very good shaft building, plant of machinery, and improved hoister over the Pease shaft on the Kansas.

Gilpin-Burroughs.—West of the La Crosse-Burroughs is the property formerly worked by the Gilpin Mining Company. They have sunk the shaft 60 feet, now being 650 feet deep. The 600-foot levels have been driven east 35 feet and west 75 feet. The 650-foot levels recently started are in 20 feet each. The stamp-mill dirt yields 4 ounces gold per cord and the smelting ore nets from $50 to $60 per ton. The lessees are working along very quietly opening up new ground as rapidly as possible. They have a good plant of machinery, hoister, and shaft building on the premises, and anticipate during the year 1884 to have mine in condition to be a steady producer.

California mine.—Since passing into the hands of the California Mine Company this mine has been worked continuously, the principal portion of the development work done for the year 1883 being on the California proper. The following development work has been completed this year: 400 feet of winzes between levels; the 1,100-foot level has been driven 100 feet east and 200 feet west; the 1,300-foot level, east 200 feet and west 500 feet; the 1,400-foot level, east 380 feet and west 430 feet; the 1,500-foot level, east 120 feet and west 100 feet. The average monthly output of smelting ore for the year has been 100 tons, and 2,400 tons of stamp mill dirt per month. Another lift of 100 feet has been commenced in the working shaft, which, when completed, will give it a depth of 1,610 feet. The manager is making preparations to put in a skip when this last lift is completed. This will be as great a depth as the proposed Belleview tunnel from Fall River will cut the California vein. At present the shaft is a double-bucket way. An average of 96 miners are employed, 36 of whom are working on tribute, and the remainder on contract and day's pay. Over the main shaft is a large building, with an L on the south, containing 100-horse-power double engines, powerful hoisting rig, blacksmith shop, ore-bins, and assorting room.

The company also own the Hidden Treasure and Gregory mills in Black Hawk, which have a capacity of 100 stamps, where all stamp-mill dirt is transported in wagons from the mine for treatment, giving employment to 16 teams and as many drivers. Ten cords per day are sent away, equal to 80 tons.

West of the California the company purchased the Hidden Treasure mine a year ago last November, which gave them the control of 1,800 feet of segregated property on the California vein. This year 60 feet was sunk in the main shaft on this end of their mine, its depth being 1,407 feet. Five hundred feet of drifts have been driven between the 1,000 and the 1,400 foot levels, at different points, but mostly west of the shaft. As the 1,400-foot east level is driven, and the 1,500-foot west level from the Standley shaft extends west, they will soon be connected, which will pretty thoroughly test the vein its full length to a depth of 1,500 feet on the east and over 1,400 feet on the extreme west. The lower east level has been driven through a splendid body of ore, and it also looks well in the bottom of the shaft.

The Register Call publishes the following as the product of the mine for 1883:

| Months. | Ore sold. | Mill gold. | Tailings. |
|---|---|---|---|
| January | $2,954 | $11,653 | $463 |
| February | 3,217 | 12,557 | 1,619 |
| March | 4,873 | 11,742 | 1,588 |
| April | 1,885 | 13,747 | 1,596 |
| May | 3,640 | 14,633 | 1,033 |
| June | 2,659 | 12,539 | 1,492 |
| July | 980 | 6,414 | 1,046 |
| August | 5,205 | 9,074 | 1,285 |
| September | 8,597 | 12,279 | 2,838 |
| October | 5,473 | 14,241 | 2,150 |
| November | 11,680 | 16,447 | 2,760 |
| December | 5,000 | 12,000 | 1,000 |
| Total | 56,163 | 147,326 | 18,870 |

The Dutchman, on the northerly slope of Quartz Hill, between the California and Burroughs, is the property of the Dutchman Gold and Silver Mining Company. The shaft is 170 feet deep and the levels aggregate 150 feet. The western portion of the Flack lode is being worked by lessees, who are making something more than wages. The shaft is 890 feet deep. The output for this year has been from the 600-foot level. The eastern portion of the Flack is worked through the main shaft 800 feet deep, to which depth the vein has been almost entirely stoped out. But very little work has been done during the year; the 350-foot level only has been worked during the year.

The Hubert mine.—Last year the main shaft on this vein had reached a depth of 350 feet, and had been worked at intervals in 1882 with varying success. During 1883 levels were sunk to 70 feet of shaftage, and a depth of 420 feet east and west from the shaft. The latter drift is in something over 100 feet, and an up-raise is being made through a fine ore-body, which is being back-stoped. The east level is in 20 feet. Both of them are now being driven. Connection has been with a shaft east of the working shaft for air, and now the ventilation is good. The stull pieces west of the shaft in the 420-foot level are from 8 to 12 feet long, which give a good idea of the width of the crevice matter. The smelting ore is galenic, carrying copper pyrites and gray copper. The mill dirt averages 4 ounces per cord and the smelting iron nets from $40 to $80 per ton.

The Roderick Dhu is worked by a pool composed of residents of Central City. Since the beginning of 1883 the main shaft has been sunk 200 feet—now 730 feet. A level east has been run from the 700-foot station 300 feet, and west 300 feet. At the 300-foot station the east level was driven 300 feet and connection made with the Borton shaft. The ore so far has been very low grade—less than 2 ounces per cord. Smelting ore is not found in quantities.

The Illinois Mining Company, working the Illinois mine, is composed of residents of Central City. Since the formation of this company the sum of $29,000 has been expended in development, in addition to what has been taken out of the mine.

The Egyptian lode property on Quartz Hill has been worked throughout 1883 by the owners. Since the pool was formed some three or four years ago the mine has produced over $100,000. The developments have been 100 feet of shaftage, 350 feet of winzes, and 550 feet of drifts; 1,000 feet of unexplored ground developed. The shaft has reached a depth of 730 feet, and gives a better showing at that depth than at any point in its upper workings. From actual measurement there are 2,100 feet of drifts, 730 feet of shaftage, and 1,000 feet of winzes in the mine, which shows that the owners have kept developing. The property consists of 290 by 50 feet on the Egyptian proper, 1,400 by 150 on the Side, and 600 by 50 feet on the Pike's Peak lode, a total of 2,290 feet of segregated property, upon which there is Government patent. At the several stations established, facilities have been afforded for handiing the ore and raising it to the surface in a systematic manner. Lately the force of miners has been very light, and employed to continue development work. Over the main shaft is a building 30 by 50, with a machinery plant consisting of a 25-horse-power engine, 30-horse-power boiler, and improved hoister. The mine is well timbered throughout, and with a view to substantiality as well as to working economically. The mill dirt, of which class of material the crevice affords the usual amount proportionate to smelting ore found in all true fissures, has given an average yield of 4 ounces gold per cord. The smelting iron nets from $85 to $185 per ton.

The Evangeline, near the Egyptian, is not as yet thoroughly developed, although good ore is in sight; a very small amount has been stoped. The shaft is 75 feet deep and the levels aggregate about 100 feet.

Denver Gold Company (limited).—This company, of London, England, who purchased the property formerly owned by the Kansas-Monmouth Company, on the Kansas and tributary veins, in Quartz Hill, Nevada district, have a main shaft down to a depth of 1,350 feet. The operations of the company for 1883 have been confined to developing and working the western ground below the 700-foot level. For the year ending December 20, 1883, there have been driven 2,245 linear feet of levels, winzes, raises, and cross-cuts. The company's 40-stamp mill has been kept running steadily, 10 stamps of which have been employed on custom ore for a large part of the time. The Kansas stamp-mill ore, up to November 30, 1883, has given an average yield of $8 per ton. The smelting ore sells at an average price of $65 per ton. There is good pay in the 800, 900, 1,275, and 1,350 foot levels. Over the main shaft is a substantial building containing a plant of machinery and hoisting rig of sufficient capacity to hoist all material mined, as well as running a 6-inch Cornish pump, which relieves the mine of water. The latter is used in their stamp mill for battery purposes. The ore is trammed in cars from the mine to the mill near by, which is a great saving in the cost of transportation.

The Kent County lode is developed by a shaft 850 feet deep. During the past year the ore extracted has come from the 600 and 700 foot levels. In the 600-foot level a party of lessees are working, the level being 941 feet. The 700-foot level is 967 feet. The crevice has an average of over 5 feet, although in places it is much wider. Considerable stoping ground yet remains between these levels, and in places is a solid streak of ore 2 feet thick. This mine is equipped with all the necessary improvements, the machinery being of such a capacity as to admit of sinking to the depth of 1,200 feet.

Southwest of the Kent County is the Barker lode. At intervals during the year it has been worked, the developments chiefly being that of extending the drifts. There are three shafts on the property, one is 80 feet, another designed for the main shaft 240 feet, and a third 200 feet. The mill dirt runs from 4 to 8 ounces of gold per cord, the smelting ore about $90 per ton net.

The Nimrod lode, the adjoining property, on the east of the Pyrenees, was worked during the earlier portion of the year with fair results. The milling ore averages 4 ounces of gold per cord, and the smelting ore $40 per ton.

The Pyrenees lode has been worked most of the year, and considerable development work has been done. The ore is worth about $80 per ton.

Charter Oak.—The property of the Aurora Mining and Milling Company has a shaft down 304 feet, about 230 feet of which has been sunk this year. The east 160-foot level has been run 100 feet and the west 160-foot level 125 feet; 260 feet from the surface a level is now in 75 feet east and 181 feet west. The mill dirt runs from 3 to 4 ounces per cord, and the smelting iron varies from $40 to $55 per ton.

National mine.—Work in developing this vein, situated on the easterly slope of Quartz Hill, near the head of Spring Gulch, has been continued throughout the year. The working shaft is now 190 feet deep, 90 feet having been sunk in 1883. At a depth of 175 feet a drift has been run east 50 feet and west 175 feet. A block of ground 50 by 50 feet has been back-stoped on the west side. The mill dirt has given an average return of 3½ ounces gold per cord, and the smelting iron has netted from $35 to $50 per ton.

Centennial tunnel.—This enterprise is aimed to cross at right angles the Mountain City, Burke, Tierney, and other veins south of the Mountain City on German Mountain. The tunnel is now in 403 feet from the entrance, and in that short distance has crossed eleven lodes that are well defined. Nothing has been done in the breast since the close of 1882. Several parties have been leasing at different times during 1883 on various veins, which they have drifted upon and sunk shafts below the tunnel level.

The Quartz Hill tunnel has been driven 25 feet this year, its entire length from the entrance now being 1,173 feet. Three hundred feet of track have been laid with T-rails, besides development work on several of the lodes cut by the tunnel in its course south.

The Columbia tunnel was commenced in August, 1882. Its starting point is just above the Quartz Hill tunnel. It has been driven a total length of 625 feet; its course is about 20 degrees west of south. Two veins have been cut, the Vidette and Argo. Along the Vidette in the back of the drift is crevice matter from 4 to 7 feet in width. Since striking the Argo a drift west from the tunnel has been run 130 feet, and as far as progessed a true fissure vein of pay has been passed through, the breast of the drift at present writing showing 2 feet of solid mineral. The developments of late have have been made with great rapidity, 3 feet being made every day.

The Boss is situated in *Quartz Valley district*, 2 miles above Central. The property generally referred to above includes the Boss, Boss No. 2, and Valverde claims, all patented. They were discovered in July, 1878. The developments on the Boss property consist of a shaft 250 feet and three others of 60 feet each. From the deep shaft there are about 1,000 feet of drifts, all work being on the vein. Boss No. 2 has a shaft of 200 feet and 200 feet of drifting; also two 60-foot shafts connected by a level. The Valverde has a discovery shaft and a tunnel of 400 feet, 5 by 8 in the clear. This is on the vein, and is equipped with track and cars for the convenient handling of ore. On Boss No. 2 is an engine house and engine, and on the other mines many valuable surface improvements. The ore is chloride of silver with galena and gray copper, and small pieces showing ruby silver. Large quantities of ore have been produced and sold from this mine, and all the product has averaged $400 per ton. In fact wagon loads have netted over $1,200 per ton. On the dump there is a large quantity of $100 ore, until lately supposed to be of little or no value. The vein is from 8 to 30 feet in width, with a pay streak of from 1 to 30 inches, or an average of 8 inches on the hanging wall. Of the large quantity of ore sold from this mine all has been the product of development work with the exception of one stope 30 by 100 feet.

In *Illinois district* the Pleasant View has been working steadily on development during the year. At the bottom of the main shaft, which is 50 feet deep, are 200 feet of drifting, exposing a vein of mineral 3 feet wide.

On the James Henry is a shaft 200 feet deep. A level at the depth of 140 feet is 300 feet long. The 90-foot level is 190 feet long.

In *Eureka district* is the Whitney mine. This vein, owned by the Rara Avis Gold and Silver Mining Company, suspended operations temporarily early in the fall, but up to date of closing down there had been 233 feet of main shaftage sunk, giving a present depth of main shaftage of 598 feet. A winze of 50 feet was sunk to connect the 300 with the 350 foot level. The 450-foot west level was driven 132 feet, and the east 450-foot level 26 feet. The lower or 550-foot level has been driven each way from the shaft a respective distance of 22 and 20 feet. The main shaft on this mine has been sunk 200 feet since the last annual review, and it is now over 600 feet deep. The west 650-foot level is in 93 feet, and that on the east 71 feet. The 265-foot level east has been driven 25 feet. A cross-cut of 64 feet has been driven to strike adjacent property belonging to the owners of the same property. The shaft has been built of sufficient size for three compartments, bucket, ladder, and pumpway. The mill dirt runs from 2½ to 4 ounces per cord. The mine is worked day and night.

Northwest of the Columbia Avenue are the Congress and Senate veins, which are a part and parcel of the Columbia Avenue Group. On the first named is a 65-foot shaft and building 20 by 25. On the latter a shaft has been sunk 52 feet. The Little Major, another one of the group, has a shaft 50 feet deep, which, at present writing, is being cribbed up. The three last named show up well for the development that has been made. The entire group can be worked by a system of levelage and cross-cuts from the workings of the main shaft on the Columbia Avenue.

On Negro Hill, the R. H. D. lode has been worked but very little. The shaft has been sunk 20 feet this year, giving it a depth of about 60 feet. At the bottom of this shaft a small amount of drifting has been done, which will be continued in the spring.

On the Freiburg nothing has been done. The developments remain as formerly, viz, shaft, 278 feet, from which drifts are run which aggregate 300 feet.

The Keystone, on the western slope of Negro Hill, has been developed by two shafts of 100 feet and 60 feet in depth, which are distant some 80 feet, but are connected by a level, which gives the miners a good air circuit for purposes of ventilation. The crevice matter is all pay, and has an average width of 4 feet, the mill dirt yielding from 2½ to 6 ounces gold per cord. This mine is estimated as having produced from first to last between $30,000 and $40,000.

In *Russell district* is the Saratoga Gold and Silver Mining Company. During 1883 this company completed the erection of a main shaft building 75 by 40, and boiler-room 28 by 30, which contains an 135-horse-power engine, double friction hoister, with 5-foot drum. A four-compartment shaft has been sunk (4 by 15 feet in the clear) 107 feet, its total depth at this time being 247 feet. Levels have been started at the 200-foot station, and have been driven 20 feet each way from the shaft and plats cut out, &c., as well as at the tunnel level. The entire shaft has been cribbed up solid with 4 by 8 redwood sawed timber, with partitions of the same. The tunnel-level struck by the cross-cut north from Willis Gulch has been timbered up both sides of the shaft, and 50 feet of winze has been sunk and level driven 30 feet west of the tunnel level. The bottom of the shaft shows an 18-inch streak of solid pyrites.

The Haselton lode has been worked during the entire year, and considerable ore shipped. The shaft is 425 feet deep, 110 feet having been sunk during the year.

On the Silver Dollar mine no sinking has been done in the shaft during the year, but 300 feet of levels have been driven and bodies of ore removed in back stoping. The mine has been explored both sides of the main shaft by 1,100 feet of levels.

The Republic Mining and Milling Company, of Russell, have sunk the main shaft on the Iron mine 160 feet since January, 1883, and driven 1,000 feet of levels. Between the third and fourth levels a winze has been sunk 60 feet, and the two levels connected. But little development has been made in the Pewabic, and that prospecting. On the other properties belonging to the company 100 feet of shaftage has been sunk and 400 feet of drifts driven.

The Wyandotte Consolidated Mine Company has been working but little during the year. Some stoping was done in the 50 and 200 foot levels.

Ayers' Leavenworth mine.—Since the fire of November, 1882, which destroyed the shaft building and machinery over the Ayers property on the Leavenworth lode, a temporary structure and a California whim have been erected, and the 400-foot east level driven 50 feet; also 65 feet of a winze sunk to connect with the level above, and about 35 feet of ground stoped out. On account of water, work was abandoned at the above point and resumed at the 270-foot station. At this point an underhand stope was made, 30 feet in length and 20 feet in depth. The water continuing to rise, work was changed to the 150-foot level, and 30 feet of drifting made east of the shaft and 30 feet west. Other miners continued work in the 120-foot level, where 150 feet east were driven, and quite a block of ground removed by underhand and overhand stoping. The ore raised varied in its richness: For the smelting ore, from $20 to $200 per ton net, while the stamp-mill dirt yielded from 2 to 12 ounces gold per cord.

The Prompt Boy, in Lemon Gulch, during the past year has been worked entirely by lessees. The shaft is 135 feet deep, and at the bottom of this is 100 feet of drifting. Considerable ore was extracted during the year that averaged $233 per ton.

*Independent district.*.—The principal mine of this section is the Perigo, on Perigo Mountain, property of the Rollins Gold and Silver Mining Company. It is one of the best defined true fissure veins in Northern Colorado, and is traceable for a length of over 1 mile by its outcroppings. The width of the crevice matter passed through in the workings of the upper cross-cut tunnel is between 10 and 24 feet. Everything between the walls goes to the stamp-mill or smelter. The east drift from point of intersection of the cross-cut tunnel with the vein is now in 175 feet, a good body of ore having been met with in its course. The level west is now in 775 feet, and as it continues depth is gained, as the mountain is precipitous. This level is connected with two shafts at a depth of 150 feet, which give a splendid air circuit. A block of ground has been stoped about 200 feet in length and from 20 to 100 feet high. The ore produced is mostly stamp mill dirt. The smelting iron has a net value of $45 per ton at the smelter. The company are the owners of many other veins, for the most part patented. The Gold Dirt, Crown Point, Colorado, and Ezra White, east and south of the Perigo, on Gold Dirt Mountain, have all been developed either by shaftage or adits on the veins.

On Perigo Mountain are the Spruce, Smart, Mammoth, Mammoth No. 2, and Pride of the West lodes, which can all be worked through the Perigo system of tunnel workings. The assessment work for the years 1882 and 1883 on all these mines has been done through the upper level of the Perigo. The tunnel is closely approaching some of them, and probably within the coming year they will be producing ore. East of them shafts have been sunk from 50 to 150 feet deep.

On the Daisy, north of the Perigo, a cross-cut tunnel has been run from that vein, cutting the vein of the Daisy, upon which a drift 50 feet west has been run opening an ore-body 4 feet wide that mills 3 ounces gold per cord.

*Enterprise district.*—The Cyclops Silver Mining Company's property embraces nine full claims on Silver Mountain, about one mile north of Black Hawk, of which four are patented. The principal developments have been on the Cyclops vein, of which the company own about 3,700 linear feet. The main shaft—over which the company have a commodious shaft-house, 50-horse-power boiler, 35 horse-power engine and hoister to match, also large ore-house—is 498 feet deep. From this there are some 2,200 feet of open levels. A system of winzes and shafts on either side connect from surface with the 375-foot and 440-foot levels, giving independent air circulation on both sides at those depths. There is outside shafting on the vein to the amount of over 700 feet. The output to date is reported at $700,000. The ore is quartz and feldspar in gangue; sometimes impregnated with brittle and native silver, sometimes mixed with galena zinc-blende, iron and copper pyrites, with more or less ruby silver in scattered masses or solid streaks of from 2 to 8 inches in thickness. The average value of ore is 100 ounces of silver per ton, the lead averaging 5 per cent. There are now in sight about 2,000 fathoms of stoping ground.

South of the Cyclops is the Fanny; the main shaft is 200 feet deep; from various depths are levels aggregating 200 feet. The mine has produced to date about 27,500 ounces silver. The property is now equipped with all necessary machinery.

The Toronto mine is developed by a shaft 120 feet deep. At 80 feet from the surface levels are run each way on vein. The east level is 75 feet, the west level 40. The east level is stoped to the surface. The character of the ore is carbonate and chloride; average value $50 per ton.

In *Lake district* is the Williams vein, the property of the Gilpin County Mining Company. This property is worked by lessees, who have employed on an average 12 men during the year. The present depth of the main shaft is 565 feet. The production was confined to different points at a depth of from 200 to 500 feet below the surface.

The Star of the West, near the Williams, has a shaft 225 feet deep, with drifts at 125 and 225 feet, respectively. The bulk of ore taken out is galena, suitable for smelting, and nets from $50 to $100 per ton.

The Register Call publishes the following in relation to the production of Gilpin County for the first half of the year 1883:

| | |
|---|---|
| Smelting ore sold | $488,175 00 |
| Gold bullion | 463,990 00 |
| Tailings sold | 219,240 00 |
| Gold from United Gregory | 35,000 00 |
| Ore sent direct to smelters and sampling works in Denver | 50,000 00 |
| Total | 1,256,315 80 |

The total production for Gilpin County for 1882 was $2,006,516, and a glance at the figures of the first half of 1883 shows an increase of $250,000. The production for the year 1883 was: Gold, $1,650,000; silver, 200,000; total, $1,850,000.

### GUNNISON COUNTY.

The mines of Gunnison County have not fulfilled the bright promises given a few years ago by the surface indications, although capital has not been needed for development, as in 1881 and 1882 the tide of immigration and flow of money were equaled only by those of Leadville.

The county is certainly blessed by railroad facilities, and the ores can find a ready market, not only in Denver and Pueblo, but the Salt Lake City smelters have agents throughout this county to buy the ores.

The Gunnison County papers have figured the output of Gunnison County for 1883, crediting the districts as follows:

| | |
|---|---|
| Tomichi district | $400,000 |
| Tin Cup district | 405,000 |
| Quartz Creek | 195,000 |

| | |
|---|---|
| Ruby and Irwin | $100,000 |
| Rock Creek and Gothic | 25,000 |
| Spring Creek | 30,000 |
| Poverty | 25,000 |
| From other sources | 25,000 |
| Total | 1,205,000 |

These figures may be the value of the output in ore, but not in bullion, or else the records of smelters and ore-buyers are at fault.

*Tomichi district.*—Situated in Robbins Gulch, 1 mile from Tomichi, and 1,000 feet from the Legal Tender, is the property of the Rockford Mining Company, consisting of a group of five claims, having an area of about 38 acres.

The Rockford claim is a true fissure, from 10 to 16 feet in width, the wall-rock being granite. The ore is galena, gray copper, and copper pyrites, the gangue being quartz, that contains considerable of what is commonly known as rosin zinc. At the surface considerable silver glance was found, but this occurred in pockets. Of the ore shipped most of it came from a small vein from 9 to 12 inches in width running parallel with the Rockford, and about 30 feet distant. The estimated value of ore in sight is $8,000, although litigation has caused a suspension of operations. The developments consist of one tunnel 50 feet long, from which a drift is run 50 feet; another tunnel 42 feet vertically below is 100 feet long, with 75 feet of drifting; and a shaft 70 feet deep possesses a drift of 60 feet.

About 300 feet to the northeast of this property a porphyry dike runs through Clover Mountain, that is 300 feet from the gulch (the wash prevents accurate knowledge of the width, but probably 600 feet will cover it); then lime crops out, and in this lime is the Legal Tender mine; a little beyond is granite. The contact between the porphyry and the granite shows considerable hematite, iron and copper glance, but lack of development on this prevents any certain knowledge of its value. Assays indicate a possible value of 150 ounces of silver to the ton.

The Sleeping Pet mine is developed by a shaft 80 feet deep and a drift 200 feet long. These workings disclose a large amount of sulphide ore, carrying native and brittle silver and some gold. This property is in good shape to ship.

The Twin Lakes is developed by a shaft 70 feet deep, disclosing a continuous streak of gray copper ore, worth about $90 per ton. A cross-cut lately started, now 35 feet, will be run to cut the vein, which it will do 400 feet from the surface. The developments consist of two shafts, one 85 feet, the other 45 feet deep, both of which are well timbered. The ore is a high grade of gray copper and galena, carrying native and brittle silver and some gold.

The North Star mine, in Galena Gulch, on the north slope of Lake Hill, is one of the largest producers in Gunnison County. The mine is worked by Harris & Blake, the lessees, who own the Cosden Sampling Works.

Until the present lessees took hold of the North Star, in August, 1883, this property lay idle two years. The mine is opened by seven shafts, but three only are being worked, viz, Shafts No. 1, No. 6, and No. 7. Shaft No. 1 is 115 feet deep, with 60 feet of levels; shaft No. 6 is 130 feet deep, with 100 feet of levels; and shaft No. 7 is 110 feet, with 30 feet of levels. The mineral is mostly galena, averaging 110 ounces silver per ton and 50 per cent. lead.

Of the Carbonate King, the Eastman, and the Bill Short Mining Companies no information has been received.

The Chicago mine, on Burro Mountain, is now one of the producers of this section. The developments consist of a shaft 65 feet deep. At 45 feet depth is a drift to the north 30 feet, and at the bottom of the shaft is another drift 30 feet to the north. Another shaft to the north of the shaft just mentioned is 25 feet deep that has produced mineral from the surface. The character of the ore is sulphurets and lead, carrying 100 ounces silver and about 35 per cent. lead.

The Lloyd Tunnel, in Burro Mountain, is at present 350 feet long, cutting several good veins and must be worked to reach its destination some 300 feet farther.

*Quartz Creek district* contains many promising properties. The ore is much like that of Gilpin County.

The Way Up has been worked steadily and with good results. The developments consist of a shaft 142 feet deep. At a depth of 70 feet a drift is run to the east 80 feet. At the bottom of the shaft is another drift east 120 feet long. These drifts are connected by a winze of 50 feet. The vein is 4 feet wide at the bottom of shaft, 2 feet of which carries a very high grade of sulphuret ore in quartzite.

The Fairview, on Fairview Mountain, has a similar formation to the Way Up, and the ore also is a sulphuret, but not so high grade as found in the Way Up. The property is developed by an incline run on the vein 375 feet, in addition to numerous prospecting holes. This lode, as also the extension known as the New Dollar, is owned by the Colorado Mining Company.

The Silent Friend mine, on North Fork, is the largest producer in this district. The mine is worked through an incline shaft 300 feet deep, the drifts, winzes, and adits aggregating 1,250 feet. The vein is a contact between slate and lime; the general character of the ore galena and carbonates. Nature did much to aid the developments of this property, large caves occurring, thus saving the sinking of shafts. The largest cave was discovered last April, of which the Denver Republican says:

"The walls are one solid mass of mineral—carbonates and galena—and the shaft evidently once consisted of the same material. It will be seen that here is a solid column of mineral 60 feet high. The thickness has not yet been determined, but all the way down the pick has been pried into it short distances on all sides, and the stuff was found compact and solid. That the ore-body in this chute is very thick is evident from the fact that a number of geodes, cracks, and fissures from 3 to 15 feet in length and from 3 to 6 feet in height exist, and running at right angles to the walls. Beautiful lime crystallizations were found in them, stained with a lustrous light-green or light-blue color from a solution of carbonate of copper. In several places some were knocked off, when the rich body of mineral underneath them delighted the eye. At the bottom of this shaft the first landing was reached, and, stepping through an arch, a large dome-like chamber was entered. This chamber is about 40 feet wide and almost 60 feet high. The round ceiling is lined with brilliant white lime crystals. The floor of this chamber is literally strewn with bowlders of all sizes, composed of carbonates and solid fine-grained galena. The thickness of this mass cannot be estimated. A few feet farther brought us to another chamber similar to the first, with the same round dome-like ceiling and masses of ore on the floor. The cave now began to narrow to about 8 or 10 feet, and became a perfect labyrinth of fissures and galleries running in all directions. The contact here is lime and quartzite and the formation is 7 to 9 feet apart, and there can be no doubt that when the floor is cleared of the large quantity of loose mineral that no trouble will be experienced in finding the vein."

The Volunteer, in Jones Gulch, has been producing steadily; the ore is a low grade of gold-bearing quartz. The same might be said of the Lucille, Sunnyside, and Fortune's Favorite.

On the Sultan and Sultana nothing beyond the annual assessment has been worked, the property being in litigation, as also the Bertha and Moonstone.

The Porcupine Group, on Gold Hill, at the head of North Fork, consists of ten claims and 60 acres of a placer on Gold Hill, the property being partly in Quartz Creek and partly in Tin Cup mining districts. Although no ore has been shipped, development has been continuous. A tunnel 1,080 feet long is run through the mountain, opening on both sides; also a branch tunnel 110 feet in length; all of which was done for less than $10,000. The tunnel and branch intersect the Eureka, Roe, Wheeler, Porcupine, Mammon, and New Carbonate veins.

The Eureka vein is 12 feet wide, being between quartzite and lime, the ore being a copper-stained quartz, averaging 13 per cent. copper, 8 to 10 ounces silver, and 1 ounce gold. On this lode a shaft was sunk 120 feet, disclosing a continuous body of ore.

The other veins all show a good body and grade of mineral so far as developed.

The Terrible mine, on Terrible Hill, is developed by an incline shaft 160 feet deep and about 300 feet of levels. The mine has been worked steadily during 1883, and about 200 tons of ore taken out in the course of running the developments. The vein is a contact between porphpry and lime, being about 4 feet in width, and yields mostly carbonates of lead, averaging in gold, silver, and lead about $100 per ton.

The Brittle Silver is a well-developed mine in Quartz Creek. During the past year development work only has been done; no ore extracted. The mine is one of the best in the gold belt, being developed by shafts and levels on the vein to the extent of over 200 feet. The ore is to be milled at Waterman's 20-stamp mill, which is situated a short distance from the mine.

The Cumberland, on Cumberland Ridge, has been idle during the year; only assessment work done. The character of ore is free-milling gold quartz, carrying about 2 ounces gold and 5 ounces silver per ton More development is needed to make this a producing mine. The shaft now is only 65 feet deep, but the ore extracted in sinking that distance paid all expenses.

The Golden Gate possesses an incline tunnel 80 feet in length, showing an 8-foot vein of low-grade, free-milling quartz, averaging probably $30 per ton.

The Gold Monument has produced some ore during the year, it having been extracted in sinking the shaft 100 feet deep. The ore is similar to that on this ridge, being worth from $25 to $35 per ton, mostly gold.

The Goldsmith has been worked continually during the year, and about 2,000 tons of ore lie on the dump that will average about $40 per ton. Developments are being pushed to put the mine in good condition for a large output in 1884. Concentrating works are being erected to treat this ore.

At the Chronicle, on Sheep Mountain, a tramway 1,500 feet long has been built recently, connecting this mine with concentrating works.

The vein is from 6 to 10 feet wide; the ore is pyrites of iron and galena, worth from $15 to $20 per ton. The developments consist of a shaft 75 feet deep. A tunnel 188 feet long connects with the bottom of the shaft. The concentrator consists of 10 stamps and 2 Frue vanners, capable of handling 40 tons of ore per day, the concentrates being worth from $65 to $90 per ton.

*Tin Cup district* is in the eastern portion of the county, and embraces Smythe, Anna, Rothschild, Emma, Boulder, Leigh, and Amazon Mountains, and Gold and West Gold Hills. Over 20,000 feet of development work was done on the mines in this district during the year 1883 on lode claims. On placer claims over 18 miles of ditches were run, and thousands of feet of fluming added. The principal outlet is over the Continental divide to Saint Elmo, a distance of 14 miles, being a good down-hill road. Another good road connects with the Denver and Southern Pacific at Quartz, a distance of 8 miles from the mines on Gold Hill, Anna, and Leigh Mountains.

The following description of the mines of this district has been furnished by Dr. W. W. Lewis, of Gunnison County:

"Tin Cup is located in the extreme southern part of Taylor Park, on the headwaters of Taylor River, 45 miles east of Gunnison City, and west of Continental divide. Tin Cup district proper embraces the location of the claims of American and Emma on Bear Mountain, Gold Hill, East and West Gold Hill, Annanet, Mount Siegle, Rothschild, and Amazon Mountains. There is a large scope of country lying north and northwest of Tin Cup, which contains several claims, all registered as belonging to the Tin Cup district.

"This district is so located that it has had a very poor outlet and inlet over a high mountain range, but it now has a wagon-road over Gold Hill or Fossil Range, reaching the Denver and Southern Pacific Railroad at Quartz, a distance of 15 miles. It is very difficult to keep the road open during winter, and makes transportation very expensive the entire year. There is also an outlet west which does not cross the mountain, and is 24 miles distant from the nearest railroad point. The Denver and Southern Pacific Railroad has surveyed a line from Quartz up North Fork of Quartz Creek over Gold Hill to reach the mines. Tin Cup has at present practically no advantages for shipping ore. The smelter has been under very poor management, and but little ore has been sold; consequently thousands of tons of 50 ounces ore and some under that are on the dumps."

This camp has always proven the richest and most productive in Gunnison County, notwithstanding the disadvantages with which it has had to contend. It is well timbered and watered, and all the mines are easily approached.

Gold Hill.—The general formation is lime and porphyry, porphyritic granite forming the east side and top of Gold Hill. From east to west there is found a series of porphyry and lime dikes, which run north and south and dip to the east. At the north end of Gold Hill the formation dips to the east, the veins lying from 12½ to 32 degrees from horizontal. In the south end and top of hill the veins are nearly perpendicular. The mineral is formed within the lime; both walls are lime or contact veins of lime and wall porphyry; the character of the other ore is chlorides, sulphides, sulphurets, galena, and some free gold. A large proportion of the ore is of high grade.

The Gold Cup mine is regarded as the best mine on the hill, and has been worked to a considerable extent by the Bald Mountain Mining Company. In 1878–'79–'80 over $450,000 worth of ore was taken out, with an outlay of about $20,000 in work and prospecting, the greater part of the work being in dead ground. It has been worked almost constantly with profit as far as labor and production is concerned, but was poorly managed. The mine has 2,500 feet of developments. The depth gained is about 185 feet; the vein has been followed from grass-roots, paying largely all the time, and is in lime. Both walls dip from 12½ to 32 degrees to the east. The vein varies from 7 to 4 feet, and narrows down to 11 inches; the average width is 42 inches; the ore consists of chlorides, sulphurets, galena, and free gold, and runs 30 to 1,000 ounces silver and from ½ to 4 ounces gold per ton. Over 1,200 tons were shipped to Denver in 1883. The mine produces 8 to 15 tons of ore daily. The average grade of present output is 168 ounces silver and 1½ ounces gold. The extension of the Gold Cup vein has 160 or 200 feet of work, and is in lime. It dips east 25°; has a 4-foot vein of carbonates and chlorides, which runs from 35 to 60 ounces per ton.

Little Gold Cup is a narrow strip of ground, lies west, and joins Gold Cup. It has an 80-foot tunnel and 38-foot shaft; there is a 9-inch vein of chlorides and sulphurets; the ore runs 100 to 500 ounces silver, in lime formation.

Iron Cup lies west of Little Gold Cup. It has a 50-foot and a 20-foot shaft; 30 feet of drifting. A large body of strong iron ore is found, and it has a 9-inch quartz-vein. The ore runs from 80 to 250 ounces per ton in silver. No gold.

Nil Desperandum has a shaft 160 feet deep, a drift of 56 feet, and several openings varying from 18 to 23 feet. Three contact veins are exposed, with a pay-streak from 3 to 11 inches in width, composed of galena and chlorides, in lime-rock gangue, milling from 40 to 60 ounces silver, and one-half to 2 ounces gold per ton.

Emma mine has a 158-foot tunnel, following the vein, which varies from 2 to 3½ feet. Vein is located in porphyry and some lime. It dips into the mountain eastward about 8°. Several cross-cuts have been run, and also 50 or 60 feet of drifting. Character of ore, gray copper and galena. Ore runs from 50 to 300 ounces silver per ton.

Jimmy Mack is one of the most productive mines in the district. During 1882 and 1883 over $126,000 worth of ore was taken out; the greater portion of it was treated at Tin Cup smelter. The vein varies from 3½ to 6 feet in width. It lies on contact line to east and porphyry to west; has a main incline shaft 370 feet, and side drifts every 50 feet. Winzes have been sunk to connect drifts, and these show large ore bodies. Very little stoping or drifting has been done, work being confined to the development of the mine. The ore consists of chlorides, sulphurets, galena, and native silver. It runs from 35 to 800 ounces of silver.

M. C. R. R., as far as developed, is in porphyry, and is exclusively an iron mine. Very pure hematite is found which contains from 65 to 78 per cent. pure iron; the most of this iron will run from 8 to 12 ounces of silver per ton. A dike of solid iron is found 17 feet in width and crops along the surface for 84 feet. No doubt this iron will, as depth is attained, narrow down and form one wall of a silver vein.

Sylvan Dell lies east of Tin Cup mine and is in lime formation; shaft 210 feet. Some ore has been taken out of the same character as that of the Tin Cup mine.

Belcher lies north of Gold Cup. It has shafts of 75 and 30 feet, and several 10 or 12 feet. Seven feet of decomposed carbonates of iron was run through and carried 30 ounces of silver.

Hidden Treasure has a shaft of 45 feet, and a cross-cut 3 feet wide carrying mineral scattered through detrital matter. The mineral found is in a quartz gangue, galena, and sulphides. The ore assays 50 to 80 ounces in silver.

Anna's Treasure has a tunnel 265 feet long, and a shaft down 27 feet, and a 25 foot adit. Hanging walls of granite gangue, quartzite, and some native copper is found. A large body of iron pyrites was encountered in the tunnel that runs from 8 to 14 ounces silver per ton.

Alhambra has a 40 foot tunnel and 30-foot shaft. It shows an 18 or 20 inch vein of sulphurets and galena gangue, lime, and porphyry mixed. Assays from 25 to 2,000 ounces in silver. Another vein on the same ground shows a large body of iron carrying 30 ounces of silver. This mine promises to be a good one with but little more work.

Josephine.—This mine was located in 1879. It has a 90-foot tunnel and 115-foot shaft. At the bottom of the shaft is a 4-foot vein of lime and porphyry contact. The ore mills 20 to 40 ounces in silver.

Carbonate King.—This has a 65-foot tunnel and a 50-foot vein of carbonate of iron through. It is principally decomposed, and carbonate of lead seems to be all through it, causing the entire bulk to mill-run from 18 to 50 ounces silver per ton.

Glasgow.—This mine was located in 1880. It has a 60-foot tunnel and an 80-foot shaft. A quartzite vein is found of 4 feet, with 2 feet of mineral, averaging 30 ounces of silver. It has a granite foot and lime hanging wall.

El Capitan Group consists of El Capitan, C. Z., Chelsea, Deer Park, and Amherst; 700 feet of development work has been done, and the ore-body has been followed a distance of 275 feet. It varies from 2 to 7½ feet in thickness, and has a lime foot wall and porphyry hanging. The ore consists of chlorides and sulphurets. This mine has produced $60,000 or $80,000 worth of ore, and has now on the dump 250 tons of 50-ounce ore. In 1883 225 feet of work was done.

Tin Cup mine is conceded to be the extension of the Gold mine, being on a direct line with the openings of these properties. It is in lime formation. This mine has caused miners much anxiety. Over $68,000 worth of ore has been taken out in one season (1882). The greatest depth at which ore was mined was 32 feet from surface. It is of high grade, being sulphides, galena, and sulphurets, running from 75 to 380 ounces silver per ton. About $16,000 has been expended in surface and development work for the improvement of the mine. A few men are now at work, and the mine is paying well.

May Flower.—This mine has two shafts, each about 100 feet, and about 65 feet of drifting on the vein. Both shafts follow the ore-vein from the surface. It is in granite formation, and no doubt is a true fissure vein, about 4 feet from wall to wall. Sulphurets, chlorides, and some specks of galena in quartz gangue are found, which mill from 85 to 250 ounces silver per ton.

West Willow has a shaft 50 feet deep and vein matter 4 feet wide; some mineral scattered through it which runs from 25 to 100 ounces silver; is in granite formation, and the outlook is very encouraging.

Grand Duke has a 75-foot tunnel and some drifting. There is found a vein in galena; ore assays 65 ounces silver per ton.

Silver Wave has a 100-foot tunnel and a 35-foot shaft. There is a contact vein of 11 inches in a 4-foot vein matter. The character of the ore is contact lime and porphyry, sulphide and galena ore, which runs 65 ounces silver per ton.

Minnie Hall mine, located in 1878, has a shaft 218 feet deep, with several drifts to the east between 70, 120, and 200 foot levels. It has several small veins cutting through porphyry, in which all work has been done. The veins encountered are supposed to be feeders from a main vein not yet reached. Galena and some sulphide ore have been taken out which run from 65 to 250 ounces of silver.

Windy Point has a tunnel 145 feet, on 4 feet of new copper, galena, and sulphurets. This ore will probably run 100 ounces silver per ton.

Ontario Group lies east of Gold Cup and Silver Cup mines, and consists of Ontario, Robert, Belcher, Eureka, Golden Chariot, and Durham. This property is developed by a shaft 165 feet, at the bottom of which is an incline of 60 feet. The Gold Cup vein undoubtedly dips under all these properties, and will be reached when proper depth is attained. They are located in porphyry which overlaps the lime, and the mineral lies in contact and also within the lime itself.

Spotted Tail.—This adjoins the Gold Cup mine. It has an 80-foot shaft and a 64-foot tunnel; also several adits. There are large croppings of quartz and copper on the surface, indicating a strong vein. In the center of this surface crop there has been what miners term a "blowout," caused no doubt by eruptive forces; some very good ore has been taken out of this natural chimney, principally sulphide and chloride. The ore mill-runs 60 to 120 ounces silver per ton.

Rothschild mine has a tunnel in 50 feet and a 25-foot drift on vein from tunnel; another shaft of 75 feet and drift from this to cut the mine at a greater depth. The ore ranges in value from 20 to 80 ounces, principally galena in quartzite gangue. Formation is in lime with hanging and granite foot walls. It has a 2-foot vein matter, with mineral irregularly distributed throughout it. All the ore taken out is yet on dump.

The Jim Fisk, Hancock, and O. K. are in granite formation, and contain galena and sulphides. They have a 4-foot vein; 200 feet of work on these properties has improved them greatly, and give promise of each developing as a mine.

On Smythe Mountain but little work has been done. Among the most promising properties are the P. R. Thombs, Ætna, Anna T., Ella C., Mohawk, Eureka, and Hawkeye.

On West Gold Hill are the Senator, Wanderer, Alhambra, Josephine, G. Z., Big Bonanza, Carbonate King Group, El Capitan Group, and the Jimmy Mack.

On the Senator a tunnel is run 70 feet, showing a vein of lead carbonates running 120 ounces silver per ton.

The Wanderer adjoins the Senator; the vein and ore about the same as in the Senator. The aggregate amount of development in shafts and tunnels amounts to 200 feet.

The Josephine has a 90-foot tunnel and a shaft 115 feet deep. A 12-foot vein is defined at the bottom of shaft of iron, impregnated with silver as high as 40 ounces.

The G. Z. has a shaft 75 feet, at the bottom of which is a drift 100 feet. The vein is 5 feet, between walls of lime; the pay streak about 30 inches, running about 40 ounces silver and 20 per cent. lead per ton. Nine hundred feet of the G. Z. is a continuation of the Jimmy Mack lode.

The Big Bonanza is developed by two tunnels, one being 80 feet, the other 60 feet long; also a shaft 15 feet deep. The vein is 18 feet wide, between walls of lime and porphyry. The ore averages 75 ounces silver and 1 ounce gold per ton.

The Carbonate King Group embraces the Carbonate King, Carbonate Queen, and Pine Flats claims. During the year no ore was shipped, it being an iron-stained porous quartz. The veins are about 6 feet wide, with well-defined lime walls. The property is worked through a main tunnel 175 feet long. About 150 tons of ore on the dump will run about 40 ounces of silver per ton.

The following information was furnished by E. C. Stoddard:

The Jimmy Mack mine was discovered in the fall of 1878, by Thomas Maher, and purchased from him by E. C. Stoddard, S. S. Chapman, and E. R. Stevens. The property has been worked since under the firm of E. C. Stoddard & Co. A patent was issued December 19, 1881. The surface improvements consist of an office, boarding-house, whim-house, sorting-room, ore-house, blacksmith shop, and all necessary buildings. The mine is situated on the western slope of Gold Hill. The side lines are run east and west; the east end line rests on the brow of the hill; the west line one-quarter of a mile from Willow Creek. The vein now being worked runs diagonally across the claim, giving the Jimmy Mack about 600 feet of the vein. The main county road from Tin Cup to Quartz passes between the buildings above mentioned. Tin Cup is 4 miles from the Mack. The lower part of the mine or claim is heavily timbered, as are most of the hills of this district.

West Willow Creek has sufficient water to run a stamp-mill at a point opposite the mine, and there is enough pitch from present workings to chute the ore to mill-site below. Country rock is lime and porphyry, and the character of ores found is various—iron with chlorides, chlorides in a white silicious rock, sulphurets, galena, sulphides, carbonate of iron and lead, oxide of iron, horn silver, brittle silver, and a few specimens of native silver have been found. Chemical analyses made in New York and Chicago show most of the ore to be milling, and from the best information I am able to obtain, the chlorided or free milling ores of the Mack should be milled at an expense of $5 per ton, and the sulphurets and such ores as need washing in salt should be reduced to an average cost not to exceed from $7 to $10 per ton. Over four hundred assays made by myself, together with those obtained from others, besides the shipments to four different smelters, show a large and continuous body of pay-ore from top to bottom, not only in main incline, but also in winze 35 feet south of main shaft. The vein pitches into the hill and east to an angle of 70°. The main shaft is 4 by 8 feet in the clear, of sawed timbers, and is sunk 280 feet. Thirty-five feet to the south a winze is sunk, parallel to main incline shaft. The first level, at a depth of 70 feet, is run south 100 feet, and north into the ground of the Mary Maher mine. The second and third levels are each way; the fourth and fifth only to winze to the south, all the way in mineral. Average width of vein, 3 feet; average width of pay-ore, 12 inches; highest shipments of ore less than car-load lot, $365 per ton; highest shipment by car-load, $135 per ton. The expense of milling and shipping to Denver in 1879 was from $60 to $80 per ton, and in 1883 $29. The highest assay in silver gave 6,385 ounces and one-half ounce of gold. With the present facilities for hoisting, not more than 6 tons of ore can be taken out in one day. The ore runs from $60 to $125 per ton. The mine is perfectly dry, with free circulation of pure air. In running the drifts many places were found where the ore can be taken out with little or no blasting. In 1879 a vein was found in the Mack by taking the course of the Mary Maher vein, then developed by a 40-foot shaft, some 300 feet from Mack, north side of line. The Maher lies northeast of the Mack, abutting thereon in exact line of Mack vein. The Mack vein runs the entire length of the Maher claim. The surface or side lines of the Maher run northeast and southwest, same as the Mack vein, running into Maher lode from first level of the Mack. Several tons of ore were taken out, which run from 75 to 125 ounces per ton. Specimens run much higher. Several tons of 150-ounce ore have been taken from the shaft 300 feet above Mack, north side line. It is thought that the ore will improve in richness as depth is attained, or as the Mary Maher is neared. Specimens were found near the surface of the vein not 100 feet from Mack side line in both Maher and Mack.

Anna Mountain formation is principally granite and porphyry. This mountain possesses many promising claims, more or less developed. The most important are the Anna Derica and the claims of the Anna Mountain Tunnel Company.

The Anna Derica has three shafts, 40 feet, 87, and 76 feet, following up the vein which crops the entire distance along the apex of the mountain. One drift from Shaft No. 1 has been run 50 feet; a tunnel has been started on the east side to cut the vein. The vein averages 4 feet, with pay from 6 inches to 2 feet, composed of galena, sulphurets, and chlorides; mill-runs as high as 1,046 ounces silver, with 1½ ounces gold. The lowest mill-run was 105 ounces silver.

The Anna Mountain Tunnel Company own eleven claims on the eastern slope of this mountain, in addition to the Texas Placer in Union Park, which has been worked extensively by hydraulics by this company during the past season. The claims are the Queen Mac, Ida V., Daisy D., Annie N., Goodwin, Prince George, Humboldt, Clarendon, Comstock, May Mulford, and the Anna's Treasure.

The Anna's Treasure is the best developed of the group, and is probably the mother vein of the mountain. A tunnel was driven 265 feet, cutting this vein, a short time since. The vein is 39½ feet between walls, which are granite and quartzite; the character of the ore is native and gray copper, showing free gold and native silver.

The tunnel in the Daisy D., 75 feet in length, shows a strong vein-matter of quartzite copper and iron.

The Queen Mac has two open cuts resting on a 4 foot vein of copper ore.

The Ida V. has four shafts, averaging 25 feet deep, showing quartz, galena, silver, and free gold.

The Annie N., Goodwin, Prince George, and Humboldt are all continuations of the vein of the Ida V. Assessments only have been kept up on them.

The Clarendon, May Mulford, and Comstock lie on the apex of the mountain, each having a shaft 40 feet deep resting on an iron quartz carrying free gold.

The Texas Placer was purchased by this company last March, and hydraulics were put up and work commenced in July. In laying the flume a large body of iron cement was encountered, which washes gold as high as from fifty to eighty colors to the pan. This body is quite extensive; a large quantity can be mined as easily as gravel, some of which was assayed in Leadville, and gave 16⅖ ounces gold and 7 ounces silver; numerous other assays from other points give equally as good returns. The company is about to put up reduction works to treat the ore; in the meantime development will be extended by night and day shifts, and shipments of high-grade ore continued.

Gold Hill.—The formation of this famous mountain is porphyry and lime, porphyritic granite forming the east and top of the hill; porphyry, lime, and granite forming the west side, known as West Gold Hill. Porphyry dikes cap or overlie the lime in many parts of the hill. The line of contact is in almost a due north and south line. The Porphyry dips to the east very heavily on the north end of the hill;

the lime underlying it also dips strongly to the east. On the extreme north end of the hill the stratas of lime lie almost flat, while on the south extreme, but north of the southern summit, that portion above timber-line, rightens up and the contact of porphyry, lime, and also the stratas of lime are cut directly through the mountain, as proven by development; on each side the veins are nearly perpendicular, have general characteristics, all of a fissure nature; the ores are principally chlorides, sulphides, sulphurets, free gold, and native silver.

The Emma mine, owned by the Tin Cup Mining Company, has been idle during the year; also the Tin Cup mine, owned by the same company.

On the Emma is a 25-foot tunnel that follows a 2-foot vein in lime and porphyry. A cross-cut 50 feet was run to define the ore-body. The ore is gray copper and carbonate of lead, running from 50 to 350 ounces silver per ton.

The Tin Cup possesses about 1,000 feet of development in drifts and winzes, and a 150-foot shaft. The ore-body is in lime on a horizontal vein, averaging 4 feet in width, carrying a high grade of silver chlorides and about 60 per cent. of lead. No ore shipped in 1883; about 800 tons of 20-ounce ore on the dumps.

The Miantonomah, is developed by an incline shaft of 60 feet on the vein, with drifts on mineral both ways at that depth. The vein is about 4 feet wide, consisting mostly of hematite iron carrying about 20 ounces silver and one-half ounce gold per ton.

The Drew has been worked steadily during the year, with profit to its owners. It is developed by an incline shaft 200 feet, with two levels. Level No. 1 is 100 feet long and 75 feet vertically above level No. 2, which is 175 feet long. These levels are connected by a winze, making the total amount of development 550 feet. This is a contact vein between walls of lime, being 5 feet wide; the filling is of iron carbonates carrying silver glance. The average value is about $150 per ton.

The George D. Roberts mine is developed by a tunnel 140 feet in and along the vein, which is 4½ feet wide. The character of the ore is hematite of iron carrying ½ ounce gold and 10 ounces silver per ton. This is a free-milling ore, and being easily worked, the owners will push developments to put the mine in shape for producing.

The Badger is developed by an open cut 60 feet and a tunnel 39 feet; the hanging wall is porphyry, the foot wall lime. The vein matter averages 6 feet, composed of gray hematite of iron with carbonates of lead. This vein showed very poor prospects on the surface, but has improved with depth.

On Rothschild Mountain are the Rothschild Group, which comprises the Rothschild, Copper Queen, and Park lodes.

On the Rothschild is an incline tunnel 46 feet, a drift on vein 16 feet; from face of tunnel a shaft 75 feet connects with this level. Mineral streak 2 feet wide; character of ore is galena and copper pyrites averaging 60 ounces silver per ton.

The Copper Queen has a shaft 30 feet deep, from which is a level 20 feet. This lode is an extension of the Rothschild, and possesses similar character of ore.

The Park lode is developed by shaft 60 feet deep disclosing a small streak of galena and copper.

On Leigh Mountain the Jim Fisk, Hancock, and Fisk lodes have 260 feet of work in shafts and tunnels, defining true fissure veins 3 feet wide, carrying sulphurets of silver.

On Emma Burr Mountain, the Emma Burr contains a mineral streak varying from ½ to 2½ feet wide; the character of mineral is carbonate and sulphides of lead, carrying from 15 to 150 ounces of silver and from ½ to 1 ounce gold per ton. The developments consist of an incline on the vein 100 feet in length.

On American Mountain, the Yellow Jacket has been shipping considerable ore, which averages about 30 ounces silver in iron pyrites. The developments consist of a shaft 152 feet deep, a tunnel 146 feet, and a drift 75 feet long. The drift connects the shaft and tunnel. The company are working a large force this winter to put the property in good condition for production.

The Little Bertie lode is developed by a shaft 92 feet and drift 10 feet. The mineral is a copper-stained magnetic-iron ore that averages 65 per cent. iron, carrying from 10 to 15 ounces silver per ton.

The *Ruby district* has added about $100,000 to the production of the precious metals during this year, but most of this comes from one mine. This amount would have been much larger, but the concentrators did not get to running until late in the summer, and then were continually stopping for alterations usual with new machinery.

The Elk Mountain Pilot, of December 27, 1883, says: "There are no mines at work at this time of the year except those that are producing some ore. Among those are as follows: Forest Queen, Gem, Great Eastern, and Bullion King. These are working small forces, except the Forest Queen, which probably has forty men on the pay-roll."

The Forest Queen has been a steady shipper during the year. The developments in shafts, winzes, and levels aggregate about 800 feet. The mineral streak is about 3 feet wide, and will average about $125 per ton. The mine is well supplied with all the necessary machinery and buildings.

The Bullion King is being steadily developed; the vein is from 7 to 10 feet wide and contains some very rich mineral. The developments consist of a shaft 140 feet deep, from which short levels have been run at various depths. Machinery was erected late in the summer, so that development is being continued during the winter.

The Venango is one of the best developed mines in the district, and has produced considerable ore. It has two tunnels 204 feet apart, one is 420 feet long, the other 90 feet. There are about 100 feet of levels on the vein and a winze 204 feet. The vein is 4 feet between walls, showing a pay streak 18 inches, which mills 150 ounces silver per ton. About 400 tons of concentrating ore is on the dump.

The Old Sheik is being worked by lessees, who are pushing development night and day. They have followed the vein 150 feet, which shows a continuous body of high-grade mineral. The vein is 50 feet wide, carrying a 2-foot pay streak that runs about $300 per ton. A level is being run on the Old Sheik to cut the Howard Extension vein, which will be reached at a depth of 200 feet from the surface. This vein carries the same character and richness of ore as the Old Sheik. In both veins native silver is being replaced by ruby and sulphide of silver, which is a favorable indication of more permanency and solidity of vein matter.

In *Elk Mountain district* but little has been done, owing to the backwardness of the concentrators in getting to work.

*Poverty Gulch district.*—Mr. Alexander McDougall states that this district lies between Ruby on the south and Gothic on the north, and is 35 miles from Gunnison City, 7 from Crested Butte, and 3 miles from the terminus of the Denver and Rio Grande Railroad at Smith's Coal Banks. It is one of the most important camps in the Elk Mountain.

The district abounds in fissure veins of argentiferous galena and gray copper, assaying from 20 to 1,200 ounces of silver per ton. Prospecting began in 1879, and since then considerable development has been made. Five mines commenced to ship ore during the season of 1883. Several sales of some importance were effected, and good companies have taken hold with a view of developing the mineral resources of their properties.

The Augusta, owned by Gage and Gilette, is opened by a 50-foot shaft and a tunnel of 150 feet in length. The vein is 6 feet wide, and carries argentiferous galena with some native silver and gold. A few shipments of ore were made as working tests which netted $4,754, or a profit of $46 per ton, after deducting the cost of mining, freighting, and smelting.

The Excelsior, owned by L. T. Baxter, is opened in three places along the vein by about 200 feet of tunneling; the ore is abundant and of high grade.

The Craoch Ailein, owned by Alexander McDougall & Co., at a depth of 25 feet shows a vein of 5 feet in width mineralized from wall to wall with argentiferous galena and gray copper.

The Freeport Mining Company own the Emma, a well-defined vein of about 10 feet, which carries galena, gray copper, and sulphurets. It is opened by two tunnels of 90 and 120 feet, respectively, in length. The ore assays from 330 to 1,135 ounces of silver per ton.

The Silver King and Boy Billy are the property of Willard Davis & Co., of Topeka. The developments consist of two shafts of 38 feet and 16 feet, respectively, and drifts and cross cuts aggregating 60 feet. The veins are large, with an abundance of rich ore.

In the Astrakhan, owned by McDougall & Co., a large body of ore is exposed by a 30-foot cut and a 12-foot tunnel; it assays at the rate of 192 ounces of silver per ton.

The Burpee and Pony mines are owned by the Poverty Gulch Mining Company, and are developed by 160 feet of tunneling; they show a large amount of high-grade ore.

The Saint Elmo, owned by C. and G. Crellis & Co., is opened by a cut and tunnel of 60 feet. The ore is high grade and in considerable quantity.

The Cabarfeigle, also the property of McDougall & Co., has a 6-foot vein developed by 60 feet of tunneling and is a heavy producer.

The Donnigs, owned by H. Lee & Co., promise to be one of the best producing mines of the camp.

The Richmond belongs to McGinness and Ryan, and is developed by a 90-foot shaft and 40-foot tunnel. The ore has assayed as high as 1,200 ounces of silver per ton.

The Rocky Mountain Developing Company own the Lakeside, which has a shaft 25 feet in depth and a 70-foot cross-cut; the mineral is rich and in good quantity.

The Cincinnati, Josephine, Homestretch, Little Well, Jacob Strader, Gift, Gem, Buckeye, Big Elephant, Big Strike, Black Hawk, Gipsy Queen, and many others may be favorably mentioned, as the indications are that with more development they will all become good producers.

The Milwaukee, near Crystal City, on Sheep Mountain, has extracted considerable ore, which lies on the dump. The property is being opened by a tunnel, which at present is 75 feet long.

The Excelsior is being developed by two drifts, one 70 feet, the other 60 feet long. In running these about 40 tons of ore were extracted that netted 52 ounces silver per ton.

In Poverty Gulch, the Emma is being opened by tunnels from which levels are run. No shipments were made, the ore being sacked and will be shipped in the spring.

The Augusta has produced considerable ore, some of which has been shipped, which netted a profit of about $50 per ton.

The Jacob Strader has come to the front as a producer. A tunnel now 145 feet long has been run to cut the vein at a depth of 150 feet from the surface. The upper workings consist of a drift 25 feet long. The character of ore is gray copper, chlorides, and sulphurets; width of pay streak, 2½ to 5 feet wide. The average mill-run is about 84 ounces silver per ton.

The Jenny Lind, near the town of Gothic, has been worked on the surface for about 200 feet and to a depth of not over 15 feet. The ore at the surface is black sulphurets, but as depth is gained the ore becomes more solidified. Gray copper prevails. The average value from 30 tons taken from along the surface gave $78 per ton.

The Eureka, Garfield, and Hancock, a group of claims on Treasury Mountain, owned by the Gunnison Silver Mining Company, are being put in shape for production during the coming year. The total amount of development is 380 feet, in shafts and tunnels. A tunnel now 105 feet long is being run to cut the veins at a point where these three veins come together. The ore is of two grades, the first runs from 65 to 110 ounces silver and from 8 to 12 per cent. copper; the second runs 22 ounces silver and 74 per cent. lead per ton.

The following description of the mines of this section has been very kindly furnished by Mr. D. B. Powers:

### REPORT OF DISTRICT ADJACENT TO CRESTED BUTTE, GUNNISON COUNTY.

Gold Basin is situated at the head of Slate River, on Slate Mountain, and embraces several valuable locations, namely: Helvetia, Christine Nilsson, Amite, Sunny South, Emma, Nancy, Angeline, and others.

The Christine Nilsson is most extensively developed, having a 50-foot shaft and 30-foot tunnel, and shows a vein 3½ feet wide that assays from 10 to 80 ounces of silver per ton. The ore carries galena, copper, arsenical iron, iron pyrites and zinc-blende. Several tons of ore are on the dump.

The Amite has a 25-foot tunnel showing a vein four feet wide between walls and carries chlorides of silver and galena.

The Fire Fly has a 20 foot tunnel showing a well-defined vein of mineral four feet wide consisting of galena and hematite of iron assaying as high as 125 ounces silver per ton.

The Silver Star adjoins the Fire Fly and is a promising mine.

The Chicago and Pittsburgh Gold and Silver Mining Company has several locations in this district, and several thousand dollars have been expended in developments. On some locations work has been carried on extensively; on others, nothing but assessment work was done. Mr. G. H. Bennington has several discoveries on Slate Mountain, but only assessment work of 20 feet has been done on each.

Poulland gives the greatest promise, carrying galena, copper, and iron, assaying on an average from 8 to 30 ounces silver per ton. There are a number of claims located by Steele & Co. The Mammoth, Paragon, and others look well, carrying galena, copper, iron pyrites, and zinc-blende. Some of these locations, with proper developments, will become good producers. Payne, Brown & Co. have several locations, showing veins of mineral, composed of galena, copper, and iron, which assay from 10 to 60 ounces silver per ton.

The Water Fall is developed by a 15-foot tunnel and a 10 foot shaft. The vein is between walls on slate and is several feet wide, showing sulphide of copper, iron pyrites, galena, and zinc-blende, which assays from 2 to 35 ounces silver per ton.

The best-paying mine in the district is the Hawkeye lode, owned by a Chicago company, and under the management of Mr. John Songer, a practical and experienced miner. This mine shows a well-defined fissure vein between granite walls, producing galena and antimonial and native silver, which runs as high as 400 ounces silver per ton. Arrangements for extensive operations are now being made.

Baxter Basin contains several fine prospects and a few paying mines. The Excelsior shipped a number of car-loads of ore last season which gave profitable returns, running 20 to 120 ounces silver per ton. It has a strong vein showing galena, sulphide of copper, and chloride of silver. There are one or two hundred other claims staked off in this immediate vicinity and are only worked to the extent of the required assessment. Many of them, with proper developments, will become producers.

The Eureka, on Treasury Mountain, has produced more than any other mine in this locality. Several car-loads of various grades of ore were shipped to the Boston and Colorado works, which averaged about $300 per ton in gold, silver, and copper. The galena and antimonial silver ores were shipped to Kansas City, and assayed 25 ounces silver and 60 per cent. lead. The shafts and tunnels developing this mine expose a large body of ore in sight. Permanent shafts and ore-houses have been erected at the mine.

The Garfield, Shakespeare, Buffalo, Comstock, Burpee, Pacific, Whale, Quaker City, Iron Hand, Raymond, Jewett, Evening Star, Fort Benton, Hicks, Murphy, Alice Taylor, Nevada, Plume, and other locations give great promise. None are shipping except the Eureka.

Evans Basin, situated 5 miles from Crested Butte, has a few fine prospects, which show galena and silver-glance, running as high as 200 ounces silver per ton.

The Antelope, one of the oldest mines in this basin, has a 20-foot shaft and a 75-foot tunnel, shows a well-defined vein between granite walls 4 feet wide, and assays run as high as 150 ounces silver per ton.

The Daisy is a very fine mine. It carries ruby silver and galena, running from 20 to 250 ounces silver, with the finest croppings in the country. Mill-runs return 125 ounces silver per ton. This mine has a 70-foot shaft and a 60-foot tunnel on the vein. There are several tons of ore on the dump.

A number of other prospects in this basin look well, but sufficient development has not been made to demonstrate its value.

Washington Gulch is located between Baldy and Gothic Mountains, and gives promise.

The Painter Boy is one of a group owned by the Elk Mountain Mining Company, and has been developed to a greater extent than any other of the group. About 600 feet of development work has been done, which consists of tunnels and shafts. The vein is 3 feet wide, between slate and porphyry, showing native and sulphurets of silver, ruby wire and brittle silver, and some gold. Six car-loads of ore were shipped to Argo smelter that assayed from 50 to 100 ounces silver and 1 ounce gold per ton.

The Wyoming is developed by a 20-foot open adit. The tunnel, now under headway, will cut the vein at a distance of 100 feet. Mineral taken from the adit assays from 20 to 250 ounces per ton, carrying chloride of silver and copper. A number of the claims in the Gulf have been worked extensively. The placer claims yield profitably.

*O Be Joyful Basin* is one of the oldest mining districts, but has not been developed sufficiently to know what it contains.

Mr. A. A. Johnson, of Crystal, Gunnison County, has furnished the following report of the mines of that and *Rock Creek district:*

This district was so situated that mineral could not be shipped from any of the mines, as packing considerable distance over rough trails was the only means of getting the ore to a market; but wagon roads have been built, which will insure more active work in the future, and mines that have never shipped ore will do so the coming summer. There, however, is not yet sufficient capital invested to bring the district into the prominence it should occupy in the production of the precious metals in this State, but will some day command more attention from the mineralogist and miner than the most sanguine can estimate. It comprises a large area situated in the heart of the Elk Mountains, with thousands of fissure and contact veins from 2 to 25 feet wide, which cannot yet be looked upon as developed.

The ore is of a varied character, being brittle wire and antimonial silver, gray copper, argentiferous galena, copper and zinc-blende, with a carbonate belt which shows croppings about a half mile wide, extending several miles in length, carrying galena and iron carbonates in fluorspar; but as yet no rich ore-bodies or chutes have been discovered in this belt, while down Rock Creek, commencing 6 miles from Crystal City, there are numerous bodies of coking coal equal to the best coal in America, the veins being from 4 to 30 feet thick. There is some talk of erecting a smelter here to treat the ores ot the district. A concentrator has been erected in Scofield, ready for next summer's work. We are situated about 20 miles from Crested Butte, the terminus of the Denver and Rio Grande Railroad, from which there is a good wagon road to this camp.

The Lulu and Utah, two claims located on the same vein, close to Scofield, are developed by a 60-foot shaft, a tunnel 150 feet, and another 130 feet, which is being constantly developed. The vein is 2 to 8 feet wide, carrying antimonial silver which assays 40 to 500 ounces of silver to the ton.

Galena Mountain.—The Iron mine is a large contact, and is being developed by an incline on the vein, which carries rich brittle silver and gray copper, which assays from 100 to 800 ounces silver to the ton. Several tons are piled on the dump, and shipment will commence in the spring.

The other promising properties are the Greenback, Whale, Duke of Wellington, Homestake, and Treasury Mountain.

The Eureka, which has produced more mineral than any other in this district, carries antimonial silver, copper, and galena, which mills $100 to the ton in gold, silver, and copper. It is a large vein; the workings, however, have been confined to a cross-cut tunnel within the past year, to cut the vein at the depth of several hundred feet, when they will be in a position to resume ore shipments.

The Buffalo is developed by a tunnel; has a vein 5 feet wide, carrying galena, copper, and antimony, assaying 40 to 300 ounces silver to the ton.

Other promising mines are the Shakespeare, Lucas, Burpee, Murphy, and Comstock Crystal Mountain.

The High Tide is developed by a 300-foot tunnel; has a vein 8 to 10 feet wide; carries a low-grade galena ore.

Three other claims are located on this vein.

The Bon Ton is developed by a shaft 100 feet deep on the vein, which is from 4 to 8 feet wide, showing decomposed galena. Assays from 10 to 40 ounces silver to the ton.

The Telephone shows a strong vein, carrying galena, and is developed by a 30-foot shaft.

The mines tributary to Crystal are situated on Sheep, Bear, Treasury, and White House Mountains, Mineral Point, and North Slope of Crystal Mountain, and adjoining basins. Sheep Mountain, however, has received the principal attention.

The Milwaukee, Silver Temple, Matchless, and Monarch are locations of 1,500 feet each on a mammoth fissure cutting through the mountain.

The principal development has been done on the Milwaukee, the ore being a brittle silver, copper, and galena, first quality ore milling 500 ounces silver to the ton. A 150-foot tunnel is being run on the Silver Temple at present, which shows a 2-foot pay streak.

The Monarch is being developed by a 150-foot shaft alongside the vein, which they expect to cut at about 100 feet.

The Grand Republic has not received the attention it should the past year, as this mine would pay to work; it is developed by a 60-foot shaft and 70 feet of tunneling. The ore is a rich gray copper and galena, milling 350 ounces silver to the ton.

The Gray Copper, an extension of the Grand Republic on the south slope, is developed by a cross-cut tunnel 75 feet, which cuts the vein at a depth of about 90 feet, exposing a vein over 7 feet wide.

The Sheep Mountain Consolidated Mining Company have a number of properties, among which the Clark 1, 2, and 3, Saint Louis, General Stone No. 2, and Baby Mine have received considerable development.

The Baby Mine, a fissure vein, has a 225-foot tunnel on the vein, the ore being galena and copper, assaying as high as 1,100 ounces silver to the ton. Work will continue on this vein until the General Stone No. 2 is cut, which is a large contact running almost at right angles with the fissure, carrying a large body of rich ore. A shaft or incline was sunk on this vein exposing 4 feet galena ore.

The New York City, another location on the above contact, shows an outcrop of galena and copper 20 feet in width, some of which assayed over 400 ounces of silver to the ton, and is developed by a 40-foot tunnel.

The Detroit and Banker's Daughter are splendid properties on one of the mother veins of the mountain, carrying a heavy galena, and lead carbonate ore assaying 10 to 60 ounces silver to the ton and developed by 75-foot tunnel, 20-foot cut and 30-foot tunnel. Considerable development will be done the coming season on these properties.

The Stonewall, a well-defined vein carrying galena assaying 60 ounces silver to the ton, has a drift 25 feet on the vein with 2½-foot streak.

The Thunderbolt, a fine fissure from 4 to 12 feet wide, is developed by a tunnel and drift; the upper tunnel shows a pay streak of copper and galena assaying 70 ounces silver and trace of gold to the ton.

The Adams Prospecting Company have eight mines, upon which development is progressing with good results.

The Superior is developed by 85 feet of shaft and 10-foot tunnel, showing 3 feet galena ore.

The Homestake has a 175 foot tunnel on the vein, also another 25-foot tunnel which shows a strong vein carrying argentiferous galena.

The Mountain Chief is developed by a drift on the vein 50 feet, showing 2 feet fine antimonial silver and gray copper, assaying 100 ounces silver to the ton, which is improving with depth.

The Orphan Boy Mining Company own and are working nine claims which are valuable properties. The Silver Purse, Orphan Boy, and Silver Falls are among the best.

The Silver Falls is a strong vein, 5 feet wide, carrying galena and copper assaying 145 ounces silver to the ton, developed by a 30-foot tunnel.

The Eclipse is developed by a 75-foot tunnel, showing galena and copper ore, with 2½ feet mineral, assaying 75 ounces silver to the ton, upon which work is progressing.

The August Flower has been developed by a drift on the vein, showing a fine body of brittle silver ore, assaying 250 ounce ssilver to the ton.

The Transit, an 8-foot vein, has 40 feet of development carrying galena and copper.

The other promising properties are the Quaker, Bonanza, Julietta, Scottish Chief, Oriental, Irene, Sifter.

The Eaton is developed by a 75-foot tunnel, is a vein 5 feet wide, carrying rich brittle silver and copper ore; assays 150 ounces silver to the ton.

Mineral Point.—The Wichita is developed by 200-foot tunnel, carrying copper and galena ore, with a 2-foot pay streak and 6-foot vein.

The Chung has a small streak of mineral, carrying wire silver, upon which a 25-foot drift is run.

The Little Orphan is developed by a 40-foot tunnel, showing a well-defined vein 5 feet wide, carrying fine copper and galena ore.

The Little Annie, a 5-foot vein, is being developed by a tunnel; shows fine antimonial ore; assays 298 ounces silver to the ton.

The Whopper is developed by two tunnels, in all about 200 feet; is a 10-foot vein; carries a heavy galena with about 200 tons of ore on the dump.

Other promising properties are the Pride of the West, Bell of Titusville, Berry & Ellis, Old Missouri, and Nickel.

Chicago Basin contains several valuable properties.

The Chicago, Saint Louis, New York, Bessie, and Great Western carry fine antimonial silver and galena.

The Chicago is developed by a 50 and 60 foot tunnel; is a 4-foot vein, and 2-foot pay streak, assaying 225 ounces silver to the ton.

The Buckner and Gray group of mines consist of three claims on one vein situated in Saint Louis Basin, and are developed by a 60-foot tunnel, the vein being 10 feet wide, the ore being a chloride assaying 150 ounces silver to the ton.

White House Mountain.—The Governor Tabor, a large contact carrying a lead carbonate, is developed by a 25-foot drift, showing 7 feet mineral assaying 40 ounces silver and 50 per cent. lead, very free from refractory substances.

The Chance shows a large vein carrying heavy galena, assaying 60 ounces silver and 70 per cent. lead.

Bear Mountain.—The Hooper group of mines have received the most development; a 120-foot tunnel is run to cut one of the veins, which shows galena and copper with a 6-foot vein. Work is progressing on these claims and will continue throughout this season.

The Carbonate Belt is situated north of Sheep Mountain.

The Plymouth is developed by a 60-foot tunnel in this ledge, and shows an iron and lead carbonate.

The Denver is developed by a 40-foot tunnel in iron and lead carbonates; assays from 5 to 50 ounces silver and trace to 2 ounces gold to the ton.

The A. & F., a location in the same belt, appears to be closer to the richest mineral in this belt, and carries a larger per cent. of lead than others.

The Capital, located parallel to the A. & F., is developed by an open cut and tunnel 25 feet, all in mineral; assays 55 ounces silver, ½ ounce to 2 ounces gold to the ton.

The Chloride of Copper is a large contact developed by an incline 30 feet, carries carbonates of copper, assays 10 to 50 ounces silver to the ton, and 22 per cent. copper.

A large belt of country lying east of the carbonate belt yet remains unprospected and will attract considerable attention, their being some rich float found in this section.

Down Rock Creek, about 18 miles from Crystal, several claims are located on a contact which shows an outcrop of 10 feet; a 75-foot tunnel is run on one claim; the ore assays 15 ounces silver and 75 per cent. lead. This property is bonded for a considerable amount to Eastern capitalists.

M. M. McDougal, esq., of Gunnison, has very kindly furnished the following account of the Cochetopa district:

The *Cochetopa mining district* lies south and southeast of the town of Gunnison, from 8 to 12 miles distant. It runs northeast and southwest 12 miles, and is about 8 miles in width, and is generally known as the Cochetopa gold belt, from the fact that gold quartz predominates and ore is found over the whole district, carrying more or less free gold, and in nearly all the dry gulches "colors" can be found. The whole district presents the appearance of an old, worn-out country, composed of low, rolling hills, generally covered with brush, and has an altitude of about 8,000 feet. The greater portion of the district is capped with trachyte, and the whole is underlaid with metamorphic granite. The "colors" and free gold in the quartz that can be found upon the surface have in time past attracted many prospectors to examine the district, and it has become quite well known throughout the State. But all prospectors soon discover that it takes capital to develop a pay mine in this district, and that a depth from 50 to 200 feet will have to be reached before good pay can be had, and therefore but little developments other than discovery shafts had been made until 1883, when work began in earnest on the Glasgow lode.

The surface indication on the Glasgow consists of a swag running northeast 35°, with here and there a yellow, decomposed, ocher-looking iron showing. A permanent shaft 7 by 4 in the clear and 105 feet deep has been sunk on the claim. A solid ore-body was found in a hanging wall at a depth of 60 feet, and is continuous as far as depth has been attained, about 11 inches in width at the top and widening to nearly 3 feet at the bottom. This ore is quite free of gangue or quartz, and is very heavy. It has a bluish-black appearance, with more or less galena sprinkled through it. It carries a large per cent. of iron, but is gradually changing to galena and gray copper. It contains gold, silver, copper, lead, bismuth, platinum, bromium, sulphur, arsenicum, antimony, and zinc; averages $20 per ton in gold and silver, principally silver. There are at present about 100 tons of this ore on dump. The gangue is a micaceous granite, wherein there is found some streaks of high-grade gray copper and galena. The foot wall has not yet been found, though a cross-cut of 14 feet has been made at a depth of 100 feet. With the proper hoisting machinery this mine can now ship ore.

The Columbus is the southwest extension of the Glasgow and has a well-timbered shaft 4 by 6 inches in the clear and a depth of 40 feet. It has the same character of ore, but not so solid. If the work is prosecuted properly on the claim it no doubt will be a regular producer of good ore.

About 1,000 feet to the north and parallel with the Columbus lies the Bell Lode. This has an enormous cropping, but it is not known at present how wide the vein is. A shaft is being sunk and is now 60 feet deep. A ton taken from this mine runs 40 per cent. copper, $\frac{1}{4}$ ounce gold, and 5 ounces in silver, and a small quantity of platinum.

There are several other promising prospects contiguous to these claims that simply have discovery assessments on them in the way of developments.

One mile southwest of the Glasgow is located the Ingomar. This mine has a substantial shaft 40 feet deep. The ore is a spar intermingled with galena and copper pyrites, and averages $40 per ton in gold and silver.

Near by are the Doubtful and the Reasoner, both promising claims.

Three miles north of this is the celebrated Lubricator mine, which has a vein 5 feet in width that is free milling ore very rich in gold. This mine should have been paying well for the last two years, but, like many other claims, trouble among the owners retarded business, and only assessment work was done.

The northeast extension is the Maple Leaf, which is very similar to the Lubricator.

There are several good prospects in this vicinity. Should work begin there is no doubt but the production of Gunnison County would be large in 1884. All the claims mentioned are located on either side of the Cochetopa Creek.

On this same belt, and about 5 miles southwest of the above-mentioned claims, and about 8 miles south of Gunnison, lies Gold Basin. A great deal of prospecting has been done in this basin, but only above the surface, until the fall of 1883, when two men began work on the Belle Flora claim, and the results are very encouraging. The ore is a schistose quartz and is fully 18 feet wide, some streaks running very high, and averages about $20 per ton gold. The surface has been stripped in many places, and a shaft sunk 40 feet; the work is now progressing. This ore can be easily pulverized, and a mill will be erected for that purpose in 1884. It is a free-milling gold ore, and the gold is very fine in both quality and size. There is no gold visible to the naked eye, but any of the vein material will make a good showing by careful panning. This is a new strike, and has not yet been made public.

The White Pine Cone figures the output of Gunnison County for 1883 as follows:

| | |
|---|---|
| Tomichi district | $400,000 |
| Tin Cup district | 405,000 |
| Quartz Creek | 195,000 |
| Ruby and Irwin | 100,000 |
| Rock Creek and Gothic | 25,000 |
| Spring Creek | 30,000 |
| Poverty | 25,000 |
| From other sources | 25,000 |
| Grand total | 1,205,000 |

The Tin Cup Miner gives the production of Tin Cup district for the year as follows:

| Source of production. | Tons. | Value. |
|---|---|---|
| MINES. | | |
| Douglass | 10 | $10,000 |
| Drew | 87 | 8,700 |
| Tin Cup | 400 | 60,000 |
| Emma | 73 | 7,500 |
| Amboy | 30 | 4,350 |
| Iron Cup | 120 | 9,920 |
| Anna Dedrika | 80 | 7,000 |
| El Capitan | 100 | 10,000 |
| May Flower | 30 | 2,900 |
| Gold Cup | 800 | 88,000 |
| Jimmie Mack | 500 | 55,000 |
| Cumberland | 530 | 13,250 |
| M. C. R. R | 400 | 8,000 |
| Yellow Jacket | 300 | 4,500 |
| Miantonoma | 80 | 20,000 |
| Windy Point | 15 | 1,650 |
| Iron Bonnet | 75 | 9,375 |
| H. D. Pearsall | 200 | 16,000 |
| Glasgow | 10 | 1,250 |
| Telurium | 175 | 26,250 |
| Napoleon | 25 | 3,750 |
| | 4,030 | 338,390 |
| PLACERS. | | |
| Union | .......... | 40,000 |
| Texas | .......... | 22,000 |
| Gray | .......... | 1,800 |
| Other places | .......... | 3,000 |
| | .......... | 66,800 |
| Total production | .......... | 405,190 |

"We find on dumps ores ranging from 30 to 60 ounces silver, over 1,500 tons in bodies of not less than 20 tons. The smaller dumps would have the amount over 2,000 tons, which, at the lowest average—$35 per ton—would swell the output $70,000.

"There has been over 20,000 feet of development work done during the present year on lead claims. On placer claims over 18 miles of ditch have been run, and thousands of feet of fluming added. Next year promises great improvements in working placer properties. Many placers which have for years lain dormant in the hands of the locators have fallen into the hands of capitalists, who are rapidly putting them in shape for large workings.

"In answer to many inquiries as to roads, markets for ore, &c., we state our principal outlet is over Continental Divide to Saint Elmo, distant 14 miles. Another good road connects with the Denver and Southern Pacific at Quartz, distance from mines on Gold Hill, Anna, and Seigel, 8 miles, all down-hill. Via a splendid road through Taylor Cañon the Denver and Rio Grande is reached at East River, a distance of 24 miles. This road leads direct to Gunnison, and is all down grade, distance 55 miles."

The production of Gunnison County for 1883 was: Gold, $100,000; silver, $650,000; total, $750,000. The silver shows an increase of $150,000 over the prior year.

## HINSDALE COUNTY.

Hinsdale County is the most easterly of the great San Juan country's silver-producing districts. Lake City, the principal camp, is located in the northern part of the county and in the center of the four mining districts—Galena, Lake, Park, and Sherman. All the extensive mining in Hinsdale has been done in the northwestern portion of the county, which is traversed in every direction by lodes, which in many places form a regular network. The country rock is highly metamorphosed, consisting of granite, trachyte, and diorite. The ore throughout this district is low grade, but by concentrating it is made marketable. The width of the vein, as a general rule, is from 5 to 10 feet, with pay streak from 2 to 4 feet. The vein filling is principally carbonate of lime, quartz, and heavy spar.

The year 1883 has been a dull one for Hinsdale County, even considering that a gain of $100,000 was made over 1882.

*Galena district.*—Crooke's Mining and Smelting Company properties, consisting of the famous Ute and Ulay, situate on Henson Creek, 3½ miles from Lake City, are the most extensively developed mines in the San Juan. The total linear feet of development on the Ulay is 4,000 feet. The Ute has 3,000 feet, and recently a rich body of ore was uncovered, averaging 20 feet in width. It is not a cave mine, but is making a cave where the ore is extracted. These mines are producing 600 tons of ore per month, and it is expected that next year they will produce 1,000 tons of ore per month. These two mines were located in 1874 by Joseph Mullen, and in 1876 were purchased by the Crooke Brothers. A smelter was then erected for the treatment of the ore, and during the past year concentrators of a capacity of 150 tons per day were erected. The first-grade ore goes to the smelter, the concentrates to Pueblo and Denver. The property is now owned by the Crooke Mining and Smelting Company (limited), of London. The Pueblo smelter purchased $100,000 in concentrates from this company during 1883.

The Compromise lode, the northeastern extension of the Ute, has not been worked beyond its necessary assessment. The width of the mineral body is from 2 to 6 feet. The ore is similar to that in the Ute at the same depth. Developments amount in all to about 200 feet. None of the veins farther west on Henson Creek have been worked beyond the annual assessment, although many show a good grade of mineral and in veins of a good width.

The Ocean Wave, 4½ miles west, still remains unproductive; the property is well developed, having three levels of 150, 200, and 450 feet in length, with considerable stoping ground. The vein is about 3½ feet wide, pay streak about 10 inches.

The Big Casino has made some advancement towards productiveness, having shipped 234 tons of ore that averaged 45 ounces silver, 55 per cent. lead. The vein is 7 feet wide, pay streak 3 feet. Character of ore is galena and gray copper.

Farther west, along Henson Creek, in the vicinity of Capitol City, are a large number of promising prospects, many of which are being developed in such a manner as to soon become mines, most notable of which are the Moro, Moro No. 2, Victor, Vermont, Capitol City Mining Smelting Company, Morning Star, Silver Chord, Silver Chord Extension, and Independence.

The Capitol City Silver Mining Company have been working the Lily vein that has produced about 400 tons of ore, 47 tons only having been shipped. This company own the Lily, Capitol City, and Capitol City Extension; the ore of these veins consists of galena, zinc-blende, iron, and copper pyrites; width of vein about 5 feet, pay streak about 20 inches.

The Lily is developed by a shaft 110 feet connected at the bottom by a drift 250 feet.

The Capitol City is developed by a shaft 137 feet, at the bottom of which is a drift 200 feet.

The Silver Chord has a shaft 90 feet, with 30 feet of drifts. The vein is 4 feet wide, pay streak 12 to 18 inches, consisting of gray copper, galena, and iron pyrites.

The Silver Chord Extension has a cross-cut 157 feet; the shaft is 120 feet, with 200 feet of drifts. The width of vein and character of vein filling are similar to the Silver Chord.

The Moro, 1 mile west of Capitol City, on Capital Mountain, has 400 feet of development in shafts and drifts. The ore is gray copper and galena, averaging 40 ounces silver per ton. The ore-body is quite extensive, and will probably average 3 feet in width.

The Moro No. 2 is an extension of the Moro, possessing about the same width of vein and the same character of vein filling.

Farther west, and on the north side of Henson Creek, is Galena Mountain.

The Independence, on this mountain, has been placed in good condition for producing. A contract was made recently for 2,000 tons of ore with the Mingo smelter, of Salt Lake City, and great improvements on the surface and underground workings. On the surface, in addition to the necessary machinery and ore-houses, a chute of 1,700 feet was built to be used in place of a tramway. The drift has been pushed to 275 feet, and the shaft will be sunk deeper when new drifts will be run. The ore is mainly a heavy galena, and runs about 40 ounces silver.

The Morning Star, on the lower end of Galena Mountain, has come to the front as a producer during the year. The ore is a heavy galena; averages $60 per ton. About 500 tons are now on the dump. This property is worked by two tunnels; the upper tunnel, 7 by 8 feet, is 170 feet in length; the lower tunnel is 260 feet, with a shaft from the bottom of lower tunnel 30 feet deep. The ore is low grade, and but a small amount has been shipped during the year.

In this vicinity, in Schafer and Horseshoe Basin, will be found very many promising prospects that possess veins from 2 to 6 feet, the paystreak showing a good grade of mineral.

Passing west to the headwaters of Henson Creek is Engineer Mountain. The veins are large fissures, carrying high-grade silver ores, consisting of ruby silver, antimonial silver, gray copper, copper and iron pyrites impregnated through the vein matter.

The Palmetto, probably the best developed mine in this section, has been non-productive during the year. During 1879 this mine came into prominence, and was then one of the most profitable and productive. This claim, together with the Ruby Queen and First National, are owned by a Philadelphia company. The vein of the Palmetto is from 10 to 30 inches wide, and carries ruby, brittle, and wire silver in a black-stained quartz.

The Polar Star mine, an extension of the Palmetto, has been steadily developed, and a large quantity of the ore extracted has been treated at Crooke's smelter. The ore is similar to the Palmetto.

The Frank Hough has been the chief producer of this section, having shipped about 800 tons of ore. Contradictory theories have been advanced respecting the character of the formation of this mine. One of the professors of the Golden School of Mines, who inspected the mine, says that it is undoubtedly a fissure vein. Mining experts declare it to be a contact or blanket deposit. Development has not been sufficient on this property to prove the nature of the formation. The managers have seen fit to work only in ore-bodies. For 30 or 40 feet from the surface no ore-body is disclosed by any of the drifts. Then in each drift to the south as far down as they are run and for 30 feet from the shaft is a continuous body of ore, varying, as a matter of course, in grade, but most of which is sufficiently high to mine and treat at a good profit, the general character being galena, gray copper, and so-called sulphurets. The drift to the west at a depth of 200 feet cuts through an ore-body 50 feet from the shaft; the other open drifts in the same direction not being in so far show the ore-body as continuing at the breast of each. This would naturally give rise to the opinion that the shaft is at the corner of a rectangular body of ore 30 by 50 feet. To prove this position, however, it would be necessary to drift in a southwesterly direction 60 feet and find ore throughout and to drift some distance northeast and find none. While the development on the Frank Hough is all-sufficient to show it to be a good mine, it is wholly insufficient to speak positively of the true formation. A 40-foot winze was completed at the 260-foot level, and a drift commenced towards the ore-body. This body has been pitching away from the main shaft, and on this drift will largely depend the future work of development. It will also determine the question of drifting in a southwest direction.

The Michigan vein of Alpine Creek has a vein 4½ feet in width. There is a streak of concentrating ore of nearly solid gray copper, from 5 to 12 inches wide, on the hanging wall, while the balance of the vein is sulphurets of silver in small pockets, iron, copper, and crystallized quartz. Twenty tons of this was concentrated at Crookes' into 6 tons of concentrate that was worth $175 per ton. The property is being systematically developed, the shaft being 60 feet deep, with 70 feet of drifting.

Farther up Alpine Creek are numerous claims, none of which have produced bullion, nor possessing any considerable amount of development; the ores being "dry ores," are low grade, and require concentrating.

*Park district* has many veins that are wide and of a fair grade, but beyond the annual assessment very little work has been done. Among the most promising looking properties are the Illinois Boy, the property of the White Cross Mining and Milling Company, the Champion, Grand Republic, Cashier, Inez, Earl, and Red Robin.

*Sherman district*, with the exception of Camp Carson, has made but little advancement in the development of its mines.

The Black Wonder, near the town of Sherman, is probably the best developed mine in the district, and during the year very little has been done toward making the property a producer. The Black Wonder, Black Wonder No. 2, and George Washington belong to the Black Wonder Consolidated Mining Company. On the Black Wonder is a cross-cut tunnel 250 feet in length, with two drifts 50 and 150 feet and a shaft 70 feet. The Black Wonder No. 2 has a shaft 30 feet deep and a tunnel 35 feet. The George Washington vein has two drifts, 80 and 150 feet in length. The veins are wide, but the pay-streaks are narrow. No ore has been shipped from these properties for three years.

On the North Fork of Cottonwood Creek are the Vermont and Vermont Extension, two claims that have been extensively worked during the past year and some ore shipped. The developments consist of a shaft 65 feet and 540 feet of tunneling. Width of vein is 6 feet between walls. The vein filling is galena, gray copper, and native silver. The ore averages 150 ounces silver per ton and 30 per cent. lead.

The Irish World, on the South Fork of Cottonwood Creek, has a large vein of gray copper, copper pyrites, and zinc-blende, carrying about

120 ounces silver. The development consists of a cross-cut tunnel 135 feet, with 30 feet yet to go to cut the vein.

At Camp Carson, a new mining camp some 5 miles from Sherman, on Lost Trail Creek, are some very promising looking claims, many of which are undergoing considerable development work.

The Hamilton, Cresco, Bonanza King, and Legal Tender are the best looking properties, and have produced and shipped some ore.

*Lake district.*—The Belle of the West, about 3 miles south of Lake City, is one of the best developed mines in this district. Nearly 200 tons of ore were extracted while in development, which was worth $12,000. No stoping has been done and probably never will be until a railroad reaches Lake City or adequate market secured. The vein averages about 2 feet, composed of quartz, galena, iron sulphurets, and gray copper.

The Belle of the East, adjoining the Belle of the West, and parallel, has not been working during the year beyond the necessary assessment work. The ore is similar to that of the Belle of the West, and the width of vein is about the same; water has been the cause of this property being non-productive, but a small amount of capital will place this in a productive state.

The Mountain Chief has been developed considerably during the year, but the ore is sacked and stored, not shipped. The vein filling is similar to that of the Belle of the West, and the vein is about 20 inches wide.

The Saint Paul Sulphuret Consolidated Mining Company is a finely developed property, but has not produced bullion during the year. There are three shafts, 45, 125, and 200 feet, respectively. Drifts are run from the bottom of each of these, but the ore being so scattered, no stoping has been done. The character of the ore is gray copper, galena, and zinc-blende.

The Golden Fleece is the modern name for the claim, formerly known as the Hotchkiss, which during 1874–'75 produced tellurium in large quantities. The vein of this property was lost, but during November, 1883, was found, and the owners now expect to work a large force of men during the coming year.

The Plutarch has been undergoing a systematic course of development, new levels have been run upon the vein, the old working cleaned out, and the property put in good condition. The ore streak varies in width, but will average 6 inches. Machinery will be placed upon this property during the coming year, and it will be thoroughly prospected.

The Mayflower has been worked in a limited manner, but no ore extracted. The ore is gray copper and zinc-blende, running about 200 ounces silver; the width of vein is 20 inches. This vein will be worked by a tunnel of 180 feet.

Among the properties in this vicinity that show mineral, but on which only assessment work was done, are the Silver Coin, Nellie M., Monte Queen, Highland Mary, Dolphin, Goshen, Minstrel Boy, Mount Morris, and Pomeroy.

I have estimated the production of this county for 1883 to have been: gold, $20,000; silver, $250,000; total, $270,000. The production of silver in the previous year was only $80,000, showing a large increase in 1883.

## LAKE COUNTY.

Too much credit cannot be given this region for reviving the interest in mining for the precious metals in the United States. From the discovery of Little Pittsburg to the present time Leadville has continued to increase its production of the precious metals, and has indirectly caused the creation of hundreds of mining camps and the production of millions of dollars. The present and future prospects of the mines of Leadville seem as favorable now as at any time in the past history of the camp. The ore re sources in the various mines in sight ready for extraction are very large and cannot be exhausted for a long time. The continued exploration work in all portions of the district is daily disclosing new ore-bodies. Many of the mines supposed to be worked out have during 1883 been resurrected. A large number which a few years ago proved failures have lately been profitable and productive mines. Lower smelting charges, cheaper transportation, and other incidentals have to a certain extent revived many of the discarded and abandoned properties and the system of leasing and the more considerative and economical working of the mines have contributed much towards this end. Quite a number of mines that a year ago were but prospects have been added to the list of producers, the most important being located on Printer Boy Hill and in the vicinity of TwinLakes.

The reputation of Leadville as one of the principal mining camps in Colorado is well sustained in the following tabular list of Leadville mines, &c., taken from the Leadville Herald:

*List of Leadville mines, their capital stock, development, production, &c.*

| Name of mine. | Location. | Acreage. | Character of ore. | Capital stock. | | Dividends. | | | Total production of mine since discovery. | Feet of development work. | Number of shafts and inclines. | Engines. | | Tons of ore produced during 1883. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Number of shares. | Par value. | Date of last. | Amount per share. | Total. | | | | Number. | Aggregate power. | |
| Adams Mining Co | Carbonate Hill | 15 | Lead carbonate | 150,000 | $10 00 | | | | $100,000 | 2,000 | 2 | 4 | 200 | 3,000 |
| Ætna mine | do | 10 | Carbonate and chloride | 2,200 | 100 00 | | | | 475,000 | 4,000 | 3 | 1 | 10 | 1,200 |
| Amie Mining Co | Fryer Hill | 9 | Lead carbonate and iron | 500,000 | 10 00 | Oct., '83 | .05 | $25,000 | 1,380,000 | 8,000 | 5 | 3 | 50 | 2,700 |
| Argentine | Iron Hill | 40 | Carbonate and chloride | 2,500 | 100 00 | | | | 1,875,000 | 15,000 | 6 | 2 | 30 | 2,890 |
| Agassiz | Carbonate Hill | 25 | do | 50,000 | 50 00 | | | | 420,000 | 4,000 | 3 | 2 | 70 | 4,100 |
| Alleghany County | Yankee Hill | 35 | | 80,000 | 10 00 | | | | | 1,000 | 4 | 2 | 60 | |
| A. Y. mine | Iron Hill | 18 | Carbonate, galena, and zincblende | (*) | | | | | 1,757,000 | 8,000 | 3 | 3 | 100 | 9,200 |
| Breece Iron | Breece Hill | 30 | Hematite iron | 200,000 | 25 00 | Feb., '80 | .01 | 2,000 | 315,000 | 1,000 | 3 | 2 | 60 | 6,000 |
| Big Chief | Carbonate Hill | 20 | Lead carbonate | | | | | | 215,000 | 2,000 | 2 | 2 | 60 | 1,300 |
| Brian Boru | Printer Boy Hill | 8 | Lead carbonate with gold | | | | | | 100,000 | 1,500 | 3 | 1 | 10 | 440 |
| Catalpa | Carbonate Hill | 10 | Lead carbonate and iron | 300,000 | 10 00 | June, '83 | .10 | 30,000 | 975,000 | 10,000 | 3 | 3 | 50 | 7,000 |
| Carbonate Hill | do | 10 | Lead carbonate | 400,000 | 10 00 | July, '83 | .10 | 10,000 | 575,000 | 8,000 | 3 | 1 | 25 | 2,700 |
| Chrysolite Group | Fryer Hill | 60 | Lead carbonate and iron | 200,000 | 50 00 | Dec., '81 | .50 | 100,000 | 8,625,000 | 42,000 | 10 | 4 | 150 | 11,600 |
| Crescent | Carbonate Hill | 10 | do | 300,000 | 10 00 | | | | 250,000 | 6,000 | 1 | 1 | 20 | 950 |
| Climax | Fryer Hill | 8 | do | 200,000 | 10 00 | Aug., '80 | .30 | 60,000 | 630,000 | 4,000 | 6 | 2 | 25 | 3,800 |
| Denver City | Yankee Hill | 12 | Iron carrying chlorides | 500,000 | 10 00 | | | | 10,000 | 15,000 | 1 | 1 | 120 | |
| Dincro | Sugar Loaf Mountain | (*) | Quartz carrying silver | | | | | | 50,000 | 1,200 | 2 | 1 | 15 | 1,100 |
| Dunkin | Fryer Hill | 10 | Carbonate and galena | 200,000 | 25 00 | Oct., '83 | .05 | 10,000 | 1,005,000 | 7,000 | 3 | 3 | 80 | 1,600 |
| Dyer mine | Dyer Mountain | 10 | Galena | 10,000 | 10 00 | | | | 75,000 | 2,000 | 2 | | | 300 |
| Dolphin | Fryer Hill | 7 | Iron carrying chlorides | | | | | | 110,000 | 2,000 | 1 | 1 | 15 | 3,500 |
| Evening Star | Carbonate Hill | 6 | Lead carbonates | 50,000 | 10 00 | Oct., '83 | .50 | 25,000 | 2,750,000 | 10,000 | 4 | 4 | 120 | 11,000 |
| Iroquois | do | 16 | Carbonate and chlorides | 250,000 | 20 00 | May, '81 | .10 | 25,000 | 600,000 | 6,000 | 4 | 2 | 35 | 1,500 |
| Iron Silver Co | Iron Hill | 70 | Lead carbonate and galena | 500,000 | 20 00 | Oct., '83 | .20 | 100,000 | 600,000 | 70,000 | 12 | 7 | 400 | 92,700 |
| Iron Hill Consolidated | do | 25 | do | 250,000 | 10 00 | | | | 510,000 | 6,000 | | | | 16,000 |
| Iowa Gulch | Yankee Hill | 10 | Chloride | 300,000 | 10 00 | | | | 10,000 | 500 | | | | |
| Hibernia Group | do | 12 | Hard carbonate, carrying chloride | | | July, '81 | .10 | 30,000 | 1,080,000 | 4,000 | 4 | 3 | 45 | 6,700 |
| Highland Chief | Breece Hill | 33 | Iron, carrying silver and gold | 50,000 | 50 00 | | | | 500,000 | 3,500 | 3 | 1 | 20 | 1,400 |
| Henriett | Carbonate Hill | 10 | Carbonate and galena | | | Aug., '82 | .10 | 20,000 | 1,280,000 | 4,200 | 3 | 2 | 70 | 5,200 |
| Gunnison | Sugar Loaf Mountain | (*) | Quartz, carrying silver and gold | | | | | | 48,000 | 1,200 | 1 | 1 | 20 | 700 |
| Leadville Consolidated | Carbonate Hill | 33 | Lead carbonate | 400,000 | 10 00 | Dec., '83 | .05 | 20,000 | 1,030,000 | 10,000 | 3 | 2 | 80 | 3,850 |
| Little Pittsburg | Fryer Hill | 20 | do | 200,000 | 100 00 | Mar., '80 | .50 | 100,000 | 6,657,000 | 30,000 | 12 | 6 | 120 | 11,500 |
| Little Chief | do | 9 | do | 200,000 | 50 00 | Oct., '83 | .10 | 20,000 | 2,850,000 | 15,000 | 6 | 2 | 70 | 6,000 |
| La Plata | California Gulch | 20 | do | 200,000 | 10 00 | Oct., '82 | .30 | 60,000 | 1,070,000 | 20,000 | 3 | 2 | 50 | 16,000 |
| Long and Derry | Long and Derry Hill | 60 | do | | | | | | 230,000 | 5,000 | 4 | | | 200 |

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Little Corinne | Mosquito Range | 10 | Auriferous quartz | 500, 000 | 1 00 | | | | 10, 000 | 600 | 1 | | | 100 |
| Matchless | Fryer Hill | 10 | Carbonate and horn silver | | | | | | 2, 500, 000 | 9, 000 | 3 | 2 | 30 | 12, 000 |
| Morning Star | Carbonate Hill | 26 | Lead carbonate | 100, 000 | 10 00 | Nov., '83 | .25 | 25, 000 | 3, 025, 000 | 10, 000 | 8 | 6 | 100 | 17, 000 |
| New Pittsburg | Yankee and Fryer Hill | 38 | ......do | 200, 000 | 100 00 | | | | 200, 000 | 4, 000 | 8 | 3 | 45 | 3, 000 |
| Robert E. Lee | Fryer Hill | 12 | Silicious iron, carrying chlorides | 500, 000 | 10 00 | | | | 5, 500, 000 | 6, 000 | 15 | 3 | 150 | 18, 000 |
| Robert Emmet | Rock Hill | 60 | Lead carbonate | 500, 000 | 10 00 | | | | 100, 000 | 2, 800 | 15 | 2 | 25 | 3, 500 |
| Silver Cord | Iron Hill | 65 | Lead carbonate, carrying gold | 448, 000 | 10 00 | Nov., '83 | .10 | 45, 000 | 1, 250, 000 | 6, 000 | 5 | 5 | 300 | 37, 500 |
| Small Hopes | Yankee Hill | 35 | Iron, carrying chloride | 250, 000 | 20 00 | | | | 75, 000 | 4, 000 | 4 | 3 | 60 | 4, 000 |
| Smuggler Consolidated | Iron Hill | 12 | Lead carbonate | 60, 000 | 10 00 | Aug., '83 | .20 | 12, 000 | 2, 280, 000 | 2, 000 | 3 | 1 | 20 | 5, 701 |
| Shields | Frying Pan Gulch | (*) | Sulphide, carrying gold | 5, 000 | 100 00 | | | | 50, 000 | 2, 000 | 3 | 1 | 40 | 220 |
| St. Louis | Breece Hill | (*) | Quartz, gold and silver | | | | | | 60, 000 | 1, 800 | 4 | 1 | 20 | 1, 500 |
| Terrible | Iron Hill | 17 | Carbonate and chloride | 100 000 | 1 25 | | | | 180, 000 | 3, 000 | 5 | 2 | 50 | 2, 200 |
| Opulent | Little Ellen Hill | 5 | Galena and carbonate | | | | | | 90, 000 | 2, 000 | 2 | 1 | 15 | 2, 600 |
| Argent | Rock Hill | 8 | Lead carbonate | 500, 000 | 10 00 | | | | 75, 000 | 4, 000 | 2 | 1 | 15 | 6, 000 |
| Antioch | Breece Hill | (*) | Quartz, gold and silver | | | | | | 8, 000 | 200 | 1 | 1 | 12 | 600 |
| Buckeye | Fryer Hill | 8 | Carbonate and galena | | | | | | 2, 000 | 1, 400 | 3 | 1 | 25 | 100 |
| Colonel Sellers | Iron Hill | 16 | Argentiferous galena and zinc-blende. | | | Nov., '83 | | | 390, 000 | 4, 000 | 4 | 3 | 60 | 7, 000 |
| Crown Point | Rock Hill | 14 | Lead carbonate | | | | | | 20, 000 | 6, 000 | 5 | 2 | 40 | 700 |
| Double Decker | Yankee Hill | 10 | Gold-bearing quartzite | | | | | | 5, 000 | 1, 000 | 2 | | | 100 |
| Florence | Printer Boy Hill | 10 | Lead carbonate. rich in gold | | | | | | 10, 000 | 1, 000 | 2 | | | 215 |
| Forepaugh | Fryer Hill | 10 | Iron, carrying silver | 80, 000 | 10 00 | | | | | 700 | 2 | 2 | 65 | |
| Great O'Sullivan | Rock Hill | 10 | Lead carbonate | | | | | | 22, 000 | 3, 000 | 1 | 1 | 15 | 1, 200 |
| Humboldt Consolidated | Carbonate Hill | 60 | ......do | | | | | | 10, 000 | 6, 000 | 6 | | | 350 |
| Lee Basin | Yankee Hill | 15 | Iron, with chloride | 500, 000 | 10 00 | | | | | 3, 500 | 3 | 2 | 100 | |
| Little Ellen | Little Ellen Hill | 35 | Lead carbonate, carrying gold | 35, 000 | 100 00 | | | | 350, 000 | 1, 000 | 2 | 1 | 110 | 7, 500 |
| Little Silver | Fryer Hill | 5½ | Lead carbonate and chloride | | | | | | 60, 000 | 1, 000 | 1 | 2 | 90 | 3, 400 |
| Maid of Erin | Carbonate Hill | 8 | ......do | | | | | | 25, 000 | 10, 000 | 3 | 1 | 30 | 400 |
| Mike and Starr | Breece Hill | 53 | Sulphide, carrying copper, gold, and silver. | 200, 000 | 5 00 | | | | 30, 000 | 3, 000 | 2 | 2 | 75 | 1, 200 |
| Nellie S | California Gulch | 4 | Lead carbonate, carrying gold | | | | | | 95, 000 | 2, 800 | 4 | 3 | 100 | 4, 000 |
| Venture | Frying-Pan Gulch | (*) | Quartz, with sulphurets of silver | | | | | | 49, 000 | 2, 800 | 2 | 1 | 15 | 1, 000 |
| Boreel | Iron Hill | 7 | Iron, carrying chlorides | | | Sept., '83 | | 15, 000 | 90, 000 | | | | | 3, 600 |

* Fissure.

The Herald says:

"There are in this district, in addition to the above mines, from fifteen to twenty properties that have contributed to the production of Leadville. The majority of the mines omitted are, however, small and irregular producers, and are mostly owned by individuals. All the incorporated mining companies have been included, and several prospect enterprises.

"So far as the location of the mines, names of managers, and capitalization are concerned, the statement is absolutely reliable."

The number of tons of ore in sight on January 1, 1884, is estimated as follows:

| | |
|---|---|
| Henriett mine | 8,000 |
| Morning Star Consolidated | 10,000 |
| Maid of Erin | 15,000 |
| Adams Mining Company | 10,000 |
| Big Chief | 3,000 |
| Other Carbonate Hill mines | 20,000 |
| Crown Point and Pinnacle | 7,000 |
| Stone mine | 12,000 |
| La Plata mine | 6,000 |
| Iron Silver mine | 5,000 |
| Moyer | 20,000 |
| Silver Cord Combination | 12,000 |
| Ruby mine | 5,000 |
| Colonel Sellers | 15,000 |
| Iron Hill Consolidated | 8,000 |
| Other Iron Hill mines | 20,000 |
| Matchless | 20,000 |
| Robert E. Lee | 12,000 |
| Hibernia Group | 10,000 |
| Small Hopes Group | 6,000 |
| Other Fryer and Yankee Hill mines | 15,000 |
| Little Ellen | 12,000 |
| Other Little Ellen Hill mines | 10,000 |
| Miscellaneous | 50,000 |
| Total | 311,000 |

Averaging the value per ton at $35 will make a total of $10,885,000, and, taking into consideration the probable yield from ore-bodies beyond the faces of the stopes now producing, it is safe to predict that the Leadville yield for 1884 will not fall short from that of 1883.

The following from the same paper in relation to the cost of reducing ores and the losses in reduction will be of interest:

"The average price of smelting fuel in 1879 was, for charcoal, 14 cents per bushel, and for coke, $36.70 per ton. In 1882 charcoal 10½ cents per bushel, and coke $15 per ton.

"To smelt ores in Leadville it requires 22 to 24 per cent. of fuel. At Salt Lake, Denver, and Pueblo 14 to 17 per cent. will perform the same services. The difference is due to the altitude.

"In 1879, when the majority of smelters operated had only two or three 42-inch furnaces, the expense for labor was $5.20 per each ton of ore treated, and in 1882, with four to five large furnaces, it was reduced to $2.80 per ton.

"The losses of metals in reduction by the Leadville smelters average about as follows: In silver, 3 to 4 per cent.; in lead, from 13 to 15 per cent. The excessive loss in lead is due largely to the low per cent. of this metal in smelting charges, being sometimes as low as 8 per cent."

The smelting and milling facilities of Leadville consist of six smelting establishments containing 24 furnaces of large capacity. From 23,000 to 24,000 tons of ore are treated monthly at these works. About 5,000 tons of coke and many thousands of bushels of charcoal are consumed monthly. There about 1,000 men employed.

The American Smelting Works contain four large furnaces, and treat about 4,000 tons of ore a month. The company owns several mines which are not operated.

The Arkansas Valley Smelter contains five furnaces 4 feet 6 inches by 6 feet 6 inches at the tuyere, and measuring 12 feet from the tuyere to the charge door.

The Fryer Hill, formerly the Cummings and Finn Smelter, is running three furnaces and treats about 100 tons a day. The establishment was purchased recently by members of the Omaha and Grant Smelting and Refining Company.

The Elgin Smelting Works were leased by the J. S. D. Manville Smelting Company in the early part of the year. Considerable ore accumulated by April 24, when the first furnace was blown in. The establishment is a success, and more ore is coming in than can be reduced by the two medium-sized furnaces at the work, and a third is being erected.

The Harrison Smelting Works has four large furnaces, which turned out 960 tons of base bullion in November. The gross production of the Harrison for the year was greatly reduced by a disastrous fire, by which the furnace-building was destroyed. The establishment was again closed down. The Harrison Reduction Works are the only ones that have provided roasting furnaces for the preparation of refractory sulphide ores that are produced by Leadville mines.

The La Plata Smelting Works have five furnaces in blast. One is new and one of the largest in the State. New dust-chambers, fume-stack, and other additions have been made.

## MOTIVE POWER.

The Leadville Daily Democrat gives the motive power employed in the mines of Leadville for the extraction and reduction of ores, as follows:

| Locations and mines. | No. of engines. | Horse-power. |
|---|---|---|
| PRYER HILL. | | |
| Chrysolite | 1 | 50 |
| Do | 1 | 20 |
| Do | 2 | 15 |
| Do | 2 | 6 |
| Little Chief mine | 1 | 50 |
| Do | 1 | 15 |
| O. K. | 1 | 6 |
| Four Per Cent | 1 | 15 |
| Buckeye | 1 | 20 |
| Virginius | 1 | 15 |
| Little Pittsburg | 1 | 20 |
| Do | 2 | 30 |
| Do | 1 | 15 |
| Amie | 1 | 25 |
| Do | 2 | 15 |
| Do | 1 | 10 |
| Dunkin | 1 | 20 |
| Do | 1 | 15 |
| Do | 1 | 6 |
| Climax | 3 | 15 |
| Matchless | 1 | 15 |
| Little Diamond | 1 | 15 |
| Dolphin | 1 | 15 |
| Emma Bell | 1 | 6 |
| Finn's | 1 | 20 |
| Hibernia | 1 | 12 |
| Robert E. Lee | 1 | 60 |
| PRYER HILL—Continued. | | |
| Robert E. Lee | 1 | 50 |
| Do | 1 | 40 |
| Do | 1 | 20 |
| Do | 1 | 15 |
| Little Sliver | 1 | 30 |
| Do | 1 | 25 |
| Forepaugh | 1 | 25 |
| Cora Bell | 1 | 15 |
| Bancock | 1 | 20 |
| Aztec | 1 | 15 |
| YANKEE HILL. | | |
| Luzerne | 1 | 10 |
| Ypsilanti | 1 | 6 |
| Big Pittsburg | 3 | 15 |
| Moyamensing | 1 | 30 |
| May Queen | 1 | 20 |
| Do | 2 | 12 |
| Forest City | 1 | 20 |
| Do | 1 | 15 |
| Denver City | 2 | 60 |
| Do | 1 | 40 |
| Result | 1 | 15 |
| Vanderbilt | 1 | 15 |
| Allegheny | 1 | 40 |
| Do | 1 | 20 |

| Locations and mines. | No. of engines. | Horse-power. |
|---|---|---|
| CARBONATE HILL. | | |
| Olga | 1 | 6 |
| Magnolia | 1 | 6 |
| Henrietta | 2 | 30 |
| Do | 1 | 10 |
| Waterloo | 1 | 60 |
| Do | 1 | 30 |
| Morning Star | 2 | 25 |
| Do | 2 | 15 |
| Evening Star | 1 | 60 |
| Do | 2 | 25 |
| Augusta Niles | 1 | 20 |
| Catalpa | 1 | 25 |
| Do | 1 | 12 |
| Crescent | 1 | 15 |
| Yankee Doodle | 1 | 20 |
| Ætna | 1 | 15 |
| Pendrie | 1 | 15 |
| Weldon | 1 | 20 |
| Carbonate | 1 | 35 |
| Prospect | 1 | 6 |
| Modoc | 1 | 20 |
| William Wallace | 1 | 40 |
| Do | 1 | 15 |
| Thespian | 1 | 50 |
| Do | 1 | 15 |
| Castle View | 1 | 15 |
| Big Chief | 1 | 30 |
| Do | 1 | 25 |
| Clontarf | 1 | 40 |
| Do | 1 | 25 |
| Brookland | 1 | 40 |
| Do | 1 | 20 |
| Wolfe Tone | 1 | 50 |
| Do | 1 | 20 |
| Agassiz | 1 | 15 |
| Gonabrod | 1 | 15 |
| Cyclops | 1 | 15 |
| Emmet | 1 | 15 |
| O'Donovan Rossa | 1 | 30 |
| Do | 1 | 15 |
| Blind Tom | 1 | 15 |
| IRON HILL. | | |
| Adelade | 1 | 25 |
| Argentine | 1 | 6 |
| Christmas Gift | 1 | 15 |
| Humboldt | 1 | 6 |
| Frenchman | 1 | 15 |
| Iron mine | 1 | 80 |
| Do | 1 | 40 |
| Do | 1 | 15 |
| Do | 1 | 12 |
| Do | 1 | 10 |
| Silver Cord | 1 | 80 |
| Do | 1 | 30 |
| Do | 3 | 15 |
| Do | 1 | 12 |
| Lime | 1 | 12 |
| Smuggler | 1 | 6 |
| Iron Hill Consolidated | 2 | 20 |
| Do | 1 | 50 |
| A. Y | 1 | 40 |
| Do | 1 | 20 |
| Collateral | 1 | 15 |
| Stone | 1 | 40 |
| Do | 1 | 15 |
| Colonel Sellers | 1 | 40 |
| Do | 3 | 15 |
| Do | 1 | 20 |
| Moyer | 1 | 20 |
| Rubie | 2 | 40 |
| Colorado No. 2 | 1 | 15 |
| Minnie | 1 | 20 |
| Horseshoe | 1 | 15 |
| ROCK HILL. | | |
| Rock & Dome | 1 | 20 |
| Emmet | 2 | 15 |
| Oro City | 1 | 15 |
| ROCK HILL—Continued. | | |
| O'Sullivan | 1 | 6 |
| Vining | 1 | 20 |
| Sequin | 1 | 20 |
| Only Chance | 1 | 15 |
| Crown Point | 1 | 20 |
| Do | 1 | 6 |
| Pinnacle | 1 | 12 |
| La Plata | 1 | 15 |
| Do | 1 | 12 |
| Gilt Edge | 2 | 15 |
| Do | 1 | 6 |
| Coon Valley | 1 | 15 |
| Montgomery | 1 | 6 |
| Helen | 1 | 15 |
| PRINTER BOY HILL AND IOWA GULCH. | | |
| Five-Twenty | 1 | 15 |
| Printer Boy | 1 | 15 |
| Empire | 1 | 15 |
| Brian Boru | 1 | 6 |
| Florence | 1 | 20 |
| Nellie S | 1 | 15 |
| Fraction | 1 | 6 |
| Ontario | 1 | 15 |
| First National | 1 | 15 |
| Julia | 1 | 15 |
| Green Mountain | 1 | 12 |
| BREECE HILL. | | |
| Mike & Starr | 1 | 20 |
| Park | 1 | 15 |
| Oro | 1 | 10 |
| Breece Iron | 1 | 25 |
| Little Johnnie | 1 | 20 |
| Highland Chief | 1 | 25 |
| Little Prince | 1 | 12 |
| Galesburg | 1 | 15 |
| ELLA HILL. | | |
| Little Ella | 1 | 35 |
| New Year | 1 | 12 |
| Silent Friend | 1 | 12 |
| Tender Foot | 1 | 15 |
| Virginius | 1 | 12 |
| Upland | 1 | 12 |
| Iszard | 1 | 20 |
| Kohinoor | 1 | 12 |
| PROSPECT HILL. | | |
| Roseville Alta | 1 | 40 |
| SMELTERS AND MILLS. | | |
| Fryer Hill Melter | 2 | 60 |
| Gage & Hageman Melter | 1 | 50 |
| Evening Star Concentrator | 1 | 25 |
| Manville Melter | 1 | 50 |
| Esty & Sampson Concentrator | 1 | 60 |
| Harrison Reduction Works | 1 | 60 |
| Harrison Sampling Works | 1 | 30 |
| Antioch Mill | 1 | 30 |
| Ballou's Sampling Works | 1 | 40 |
| Omaha and Grant Sampling Works | 1 | 25 |
| La Plata Smelting Company | 2 | 65 |
| American Smelting Company | 2 | 70 |
| Arkansas Valley Smelting Company | 1 | 120 |
| Do | 2 | 60 |
| Do | 1 | 20 |
| Arkansas Valley Sampling Works | 1 | 45 |
| Leadville Silver and Gold Milling Company | 1 | 75 |
| Oro Stamping Mill | 1 | 30 |

## RECAPITULATION.*

| Locations. | No. of engines. | Horse-power. |
|---|---|---|
| Fryer Hill | 43 | 887 |
| Yankee Hill | 18 | 420 |
| Carbonate Hill | 45 | 1,070 |
| Iron Hill | 37 | 884 |
| Rock Hill | 19 | 263 |
| Printer Boy Hill and Iowa Gulch | 11 | 146 |
| Breece Hill | 8 | 142 |
| Ella Hill | 8 | 130 |
| Prospect Hill | 1 | 40 |
| Smelters and mills | 22 | 1,170 |
| Total | 212 | 5,152 |

*To the above may be added about 1,000 horse-power used for compressors and steam-pumps.

The number of engines made use of on the mines is about 178, of which 61 are 15 horse-power each, this being the size of engine most frequently used. For prospecting, a 6-horse-power engine, generally known as a baby hoister, is used. Of these there are between 20 and 30 about the camp.

Fryer Hill.—This division of Leadville mining district consists of three distinct parts, West, Main, and East Fryer Hill.

West Fryer, or Lime and Fairview Hills, belongs, with the exception of a few claims, to the Chrysolite Group.

If Lime Hill contains much pay mineral it certainly is obstinate in returning it. The contact is everywhere found, and plenty of vein matter, but, except in the Colorado Chief claim, of the Chrysolite Group, the others have yielded no pay mineral.

The next part of Fryer Hill is the great bonanza field of the past, and is still of productive importance. There are very few other mines in Colorado that can compare in value and quantity to the present output of the producers here, among which are the Chrysolite, Little Pittsburg, Little Chief, Climax, Amie, and Dunkin; also the O. K. and Virginius, that have yielded handsomely although irregularly.

The third part of Fryer, or, as it is known, East Fryer, is just now the great reserve bank of Fryer Hill. Impending sales have suspended the wholesale shipments and the limitation of work to mere exploration, the blocking out of ore-bodies, and the sale of what little ore is required to meet current expenses. The Matchless, Lee, and Albion are the largest producers.

The Chrysolite Consolidated Mining Company has produced, since the organization of the company in 1879, about 77,027 tons of ore, containing something like 4,302,993 ounces silver and about 29,525,050 pounds of lead. The amount of work done during the past year amounts to nearly 7,000 feet of drifts, 1,000 feet of winzes and raises, and 200 feet of shafting. The amount of underground workings aggregate about 49,347 feet, or nearly 9 miles. The property of this company consists of eleven claims, containing in all 59.94 acres. The ore averages $35 per ton, and on account of the iron contained is desirable for smelting purposes.

The Little Chief Mining Company, one of the old bonanzas of Fryer Hill, was but a short time ago given up as "worked out," in spite of which, through good management, the property has settled its indebtedness, and has about $100,000 in its treasury. Developments and prospecting have been steadily pushed throughout the year, and the strikes, although not of the extent formerly found in this property, have been quite large.

The O. K. mine, adjoining the Little Chief mine, has extracted considerable ore during the year, the same coming from a drift near the line of the Little Pittsburg and Little Chief. The ore averaged 20 per cent. lead and 50 ounces silver per ton.

The Little Pittsburg Mining Company, another property that was supposed to have been worked out, has during the year shipped 11,500 tons of ore to the smelters. The mine has employed about 50 men on an average for the year, the monthly expenses ranging from $8,000 to $9,000. The principal work has been carried on in the Dives and Little Pittsburg claims. The old workings of the mine have been cleaned out by miners working on tribute; new machinery placed on No. 10 shaft, preparatory to prospecting the northwestern portion of the Little Pittsburg claim.

The Amie, which is consolidated with the Deer Lodge, possesses about 15 acres adjoining the Little Pittsburg property. During 1879 and 1880 this property produced about $700,000 worth of ore. Since 1881 the property has been leased. This year the company has been working, and with fair results, the northern portion of the Amie claim.

The Dunkin Mining Company, although not one of the largest producers, has been a steady one, having paid to date $210,212.11 in dividends. This company own a large tract of virgin ground in the northern portion of the Dunkin claim, although the ore-bodies in the upper workings have shown signs of exhaustion. On an average nineteen men were employed until November, when the force was cut down. The company possesses an ample capital in their treasury to continue exploration and development The ore is a galena, ranging in value from $500 to $600 per ton, but is generally found in pockets and stringers.

The Climax.—This small piece of property, which adjoins and at one time formed part of the Climax, on Fryer Hill, was last summer proved to be very valuable. The lower level this season produced 4,000 tons of high-grade ore. The upper levels have been worked for three years. On the 60-foot level the grade of the ore has varied from 20 ounces to 500 ounces; its average value, including 25 per cent. lead, has been $35 a ton. There are several shafts on the property; the Montana shaft is 225 feet deep, the Whip shaft 90 feet, and another shaft 120 feet. These shafts are all supplied with the requisite machinery, steam hoister, ore-houses, &c.

The Matchless mine.—Nearly a year ago the Matchless mine was put in first-class order, anticipating a sale, which did not take place. Pending negotiations there was nothing produced, but since the sale was abandoned the Matchless has averaged 50 tons per day. The ore is dry, heavily charged at times with chlorides. The east incline from the north drift on the 160 foot level of the No. 3 shaft discloses more rich ore than ever heretofore. There are 3 feet of ore, prolific in horn-silver, the limit of which was supposed to have been reached some time ago, now opened above a streak of porphyry. This body of rich ore gives indications of opening out into a very large mass of high-grade material to the southeastward. To the north and eastward the rich ore-body has been followed by an incline drift for about 40 feet, and still shows a strong deposit of horn silver-bearing ore. The rich mineral is bedded on black iron, which carries from 30 to 50 ounces in silver to the ton. The 200-foot level from the No. 3 or north shaft is also showing up very satisfactorily. An incline here runs from the shaft eastward to the Robert E. Lee line, a distance of 185 feet. At 90 feet from the shaft ore is encountered, and the developments continue in pay mineral to the Lee line. A drift then runs northward along the line for 87 feet in mineral. Another drift, started midway between the shaft and Lee line is now being driven, and up to the present time has advanced 100 feet in milling ore. Manager Leonard is also prosecuting work about the center and southern portion of the Matchless claim, and is succeeding in opening up large new resources, as well as extracting a great deal of fine ore.

The Matchless mine has now produced and shipped ore to the smelters to the value of $1,175,000, exclusive of smelting and milling charges.

The Stonewall Jackson, near the gulch south of the Matchless mine, gives promise of becoming a profit to the lessees and a benefit to the camp. The mineral is a carbonate of lead, with some iron, and shows chloride of silver. The shaft is now down a distance of 200 feet. A drift was run from the shaft at a level of 180 feet, and several cross-cuts have been run on this drift, which is now in 130 feet. In one of these cross cuts, near the surface of the drift, a winze has been sunk to a depth of 30 feet, and a second level is being driven from the bottom of the shaft to connect with it. The ore streak as yet is small, but it has at times opened out to a height of 6 feet, with a width of 6 to 10 inches.

The Dolphin, adjoining the Matchless, has been worked under a lease. The work this year has been mainly development, hence a small production. The mineral carries no lead, but is very rich in chloride of silver. The developments consist of a shaft, 120 feet, with 600 feet of drifts at the bottom.

The Deer Lodge, belonging to the Dolphin Company, has a shaft 225 feet deep, with levels at the depth of 175 feet and 225 feet, the aggregate being 300 feet.

The Hibernia Mining Company is composed of the Hibernia, May Queen, and Surprise claims. The ore is pockety, though very rich. Lessees who have been working in the northern portion of the Hibernia claim have been extracting considerable ore, the output ranging from 50 to 100 tons per month, the ore having a value of 35 to 250 ounces silver per ton. The higher grade of ore comes from the old workings of the Hibernia, at the extreme northern end, between the Matchless and R. E. Lee properties.

A recent strike in the new south shaft on the May Queen claim is proving one of the most important of the year. The shaft disclosed 21 feet of ore of good value.

Relating to the Robert E. Lee the following is clipped from the Leadville Democrat:

"The record of the mine is truly wonderful. It was long regarded as worthless. On the 14th of January, 1880, there was taken from this mine, in the short space of seventeen hours, ore to the value of $118,500. During 1880 it divided nearly a million dollars among the owners. The mine has attracted much attention, and the commencement of wholesale shipments would add largely to the silver production of the country. The operations in the past year have been solely directed toward the further development of its immense mineral wealth. About fifty men are constantly employed in this work, and no shipments are made except of ore which must be taken out in the prosecution of the work. This alone covers more than the expenses. The Lee is considered the nucleus of a group of mines which partially surround it in a demicircle to the north and east. In the Matchless, on the west, it has a worthy confrère, which is only second to the Lee in the silver contents of its shipments. The surface improvements are complete, substantial, and worthy of the mine.

The machinery is adapted to the hoisting of a large output and thorough drainage of the mine."

The Enterprise Mining Company owns the Forepaugh and Alpha claims, on East Fryer Hill, near the Sliver claim. These claims cover an area of about six acres. The Jennie Lee claim, lying adjacent to the Alpha, is also claimed by this company, but as yet it has no title, the property being in litigation. In December mineral was struck in the Forepaugh shaft, at a depth of 370 feet, carrying silver and gold in iron pyrites. The ore is of a refractory nature. The ore-body penetrated by the shaft shows a thickness of over 6 feet, with a dip to the northeast, the contact above being 25 feet thick. This shaft is the deepest of any on Fryer Hill, the ore disclosed being different from anything heretofore found in this locality.

The Little Sliver property lies directly east of the R. E. Lee, and contains some of that extraordinarily rich ore which has made the latter mine famous. Just now the ore extracted is of low grade, the mineral being a silicious, hard, gray carbonate. The mine is being worked principally with a view to exploration and development, and as a consequence the output is very light.

The Aztec mine, situated in the basin between Fryer and Yankee Hills, is owned by the Leadville Aztec Mining Company. The mineral is a carbonate of lead, carrying considerable silica, and will net from $25 to $30 per ton. The ore is found in crevices and seams in limestone and flint. At various times the ore-pockets assume considerable magnitude, but so far the ore extracted has paid little more than the working expenses of the property.

Of the mines on Yankee Hill the Leadville Democrat says:

"Yankee Hill may be divided into three parts. It is inclosed by Big and Little Stray Horse Gulches, which join at Fryer Hill on the Solid Muldoon and Last Chip premises. The promontory at the point of junction is known as Ypsilanti Hill, the first part of Yankee. It contains the following mining claims and mines: The Luzerne, a recent development of low-grade mineral; the Olga, the same, but of older date; the Ypsilanti, thus far of great promise and little realization; part of Vulture, Colorado Chief, and New Discovery (also Fryer Hill mines); then the extensive property of the New Pittsburg Mining Company, as the Ida Nyce, Bullion, Joe Bates, Big Pittsburg, and Stray Horse. The second part or section is the site of prior discoveries in the Hibernia, on the line of the Matchless, and of the recent strikes in the Moyamensing, May Queen, and Forest City. The shipments from this new point will average over 100 ounces in silver. The Denver City and Shamus O'Brien have a similar body of silicious ore, with iron and chlorides; but notwithstanding the expenditure of quite a fortune in prospecting therein, neither quantity nor quality of ore has up to date reimbursed the enterprising owners. It is highly probable that this property will be developed by line workings of the Forest City. Part of the Result and Robert Emmet mines will share the future of the Denver City. The third section of Yankee Hill embraces all the claims between the aforesaid second section and Little and Big Stray Horse Gulches up to Adelaide City and Greenwood Gulch. Pay mineral has been shipped from the Chieftain or Yankee mine, the Hawkeye, Scooper, Fairplay, Double Decker, and Del Monte, and that of all varieties, as iron, silicious chloride ore, hard carbonate, ochery silver and gold ore, but very little lead on the whole, and the grand total of shipment has not been excessively large. The other claims belonging to this section are the Hunkidori, Young Carbon, Highland Mary, Snow Storm, part of Terrible, Silver

Basin, Old Stonewall, Hard Cash, Logan, Woodruff, Mayflower, Echo, Laurel, Clara Belle, Greenwood, Little Champion, Little Maud, Loveland, Superior, Red Headed Mary, Logan, Keystone, Buckeye, Sappho, Rabbit, J. B. Grant, White, Little Stella Holdine, Danie, Congo, Little Miami, Edmonson, Silver King, Aztec, and others."

The New Pittsburg Mining Company consists of eight claims and portions of claims, embracing in all about 32 acres. It is developed by 13 shafts and about 1,400 feet of underground workings. The property was formerly known as the Big Pittsburg Mining Company, and, after repeated failures to find ore, the company was reorganized and placed under the management of Frank Buckley, who has pushed development.

The Luzerne, situated at the head of East Sixth street, has come to the front during the year as a producer. The ore consists of sand and hard carbonates and ocher, in addition to carrying an appreciable amount of lead. The location is isolated from working mines, being situated about midway between the Henrietta and Chrysolite and Little Pittsburg mines, and opens up a section of territory heretofore universally condemned. The shaft is 175 feet deep, with but a small amount of drifting. The shaft will be sunk deeper and developments pushed; new pumping machinery will also be placed, as the workings are considerably troubled by water.

The Small Hopes Mining Company consists of a consolidation of the Small Hopes, Gone Abroad, Ranchero, Result, Robert Emmet, and Forest City claims. This property is attracting considerable attention at present on account of the high-grade ore recently found in the Forest City claim. The ore-body is large and will average $110 per ton in silver, very little lead being present. The workings of the Forest City consist of two shafts. One, the Elkins, is 160 feet deep. An east drift is 55 feet, with 12 feet of ore; a south drift, 50 feet, with 5 feet of ore in the breast; a north drift, 45 feet, with some mineral. The east drift goes to the May Queen line, whence one drift runs north 78 feet, and is now in barren contact; another, going south along the May Queen line, has a full breast of ore. The course of the main south drift is directed towards the second shaft, 168 feet distant. Another shaft is 140 feet deep, and has been in the iron part of the vein for some time, with some good ore interspersed. Both shafts are to be connected by the south drift from the Elkins. The surface improvements are substantial and complete. The Elkins shaft is covered with a lofty and spacious house, 70 by 26 feet, with a series of bins in addition.

The Denver City Mining Company was organized to work the claims known as the Quadrilateral, the Shamus O'Brien, and the Denver City, all lying southeast of the R. E. Lee, Hibernia and Little Sliver. Two shafts were sunk nearly at the two ends of the property, from which drifts were run in almost every direction, that failed to disclose any continuous body of mineral, though the miners constantly struck chlorides in the iron.

The company becoming involved in debt, sold half of its property to a new company called the Lee Basin Mining Company, which is, in fact, the original owner of the Denver City Company. Both companies then began explorations, but as yet have failed to produce ore in paying quantities.

The Scooper, in Iowa Gulch, is the property of the Iowa Gulch Mining Company. This mine is being thoroughly explored by lessees, who have been extracting some rich ore from stringers and small pockets.

The Double Decker, just across the gulch from the Adelaide, promises to regain its former prestige as a producer of rich ore, having recently disclosed some high-grade chloride and horn-silver. The property lay idle for a long time, when lessees took hold and new developments disclosed good streaks of ore.

Of Carbonate Hill the Democrat says:

"This district is inclosed by Big Stray Horse, Stray Horse Valley or East Leadville, California Gulch, and Graham Park. The claims located thereon may be divided into four divisions: First, the apex locations; second, those on the fall of the contact; third, those on the dip of the contact behind the apex claims; fourth, those on the croppings of the fallen part of the Iron Hill contact. The apex locations are all mines, and have been or are large producers. They are, commencing near California Gulch, the Shamrock, Carbonate, Ætna, Yankee Doodle, Crescent, Catalpa, Evening Star, Morning Star, Waterloo, Henriette. All are famous mines. To the second class belong parts of the aforesaid of the first class, but wholly the following: A large part of the Henriette and Waterloo, the Portland, Carleton, Forsaken, Augusta Niles, Dillon, Wildcat, Buckeye Belle, Washburne, Orion, Rough and Ready, Pendery, the larger part of the Ætna, Glass, and others of no demonstrated value, such as Gem of Leadville, Little Diamond, Muchachinack, Carbonate King, Crawford, Big Dutch, Barnes, American Eagle, Pocahontas. Among these the following have been or are producers: Ætna, Pendery, Rough and Ready, Glass, Forsaken, Carleton, Henriette, Waterloo, Augusta Niles; also small parts of Catalpa, Crescent, and Morning and Evening Stars. The third division is formed by the following mines: Maid of Erin, Brookland, Clontarf, Big Chief, Monte Christo, Wolfe Tone, Little Giant, and the Modest Girl; and the following other locations, which time will surely prove of high value, as the Castle View, Excelsior, William Wallace, X 10 U 8, Tip Top, Modoc, Prospect, Thistle, and Utah. Of possible but less certain value are the Dead Broke, Washington, Emmet, J. C. Wilson, and Last Rose of Summer. The fourth division embraces the Agassiz, Ranchero, Gonabrod, and Cyclops mines, on the croppings of a fallen part of the Iron Hill contact. The Mahala and Greenback are located upon that same contact, but have not been opened into paying mines. Part of the Robert Emmet belongs to this division. The central part of Carbonate Hill, that is, the mines in the rear of the apex locations, will be large producers of carbonate ore for several years to come. Sulphides have been encountered in the Wolfe Tone at a depth of about 700 feet. The extent of that class of ore in Carbonate Hill is entirely unknown, as the development has been confined to that one mine."

Relating to the geological structure of this hill, the following is taken from the essay of Prof. L. D. Ricketts, that gained for him the Ward fellowship at Princeton College. Professor Ricketts had every advantage possible in compiling this work, having had access to the workings of the different mines and the personal aid of the best mine managers of Leadville.

"The structure of Carbonate Hill was first described by S. F. Emmons, and a description of it was published in 'An Abstract of a Report on the Geology and Mining Industry of Leadville' early in 1882. Notwithstanding the sufficient data then brought forward to establish his theory and the section given of the hill, his statements have been contradicted, and other theories have been advanced to account for the existing phenomena.

"The recent developments on the Henriette, Morning Star Consolidated and Evening Star properties, and on the claims both east and west of them, have proved beyond a doubt the true structure of the hill. All the formations, including the main sheets of porphyry, have a general dip of 10° to 15° east or a little south of east. Consequently they rise towards the western face of the hill and the upper formations outcrop, giving a very favorable opportunity for examination. The Evening Star shaft No. 5, situated on the outcrop of the blue limestone horizon, shows the nature of the lower formations. This shaft has a depth of 200 feet, and a drill boring from the bottom extends 200 feet farther. The lower 100 feet of the boring is in the Cambrian quartzite—for the most part pure white and saccharoidal. Near the top only it becomes impure, slaty, and then calcareous, gradually changing into the silicious white limestone of the Silurian formation. The latter bed has a thickness of 100 feet, and occupies the upper 100 feet of the boring. From sections of the quartzite visible in other localities Emmons found it to have an average thickness of 150 feet. There can be but little doubt that the underlying archæan gneiss would have been struck had the boring been carried 50 or at most 100 feet farther. The white limestone is separated from the blue limestone by a thin, irregular, and in this part of the hill poorly defined sheet of quartzite, probably of Devonian age. No evidence of the existence of this stratum could be found in No. 5 shaft.

"The blue limestone is of Lower Carboniferous age. It has here a thickness closely approximating 150 feet, and forms the last of the sedimentary beds now existing on the hill. It is in this formation that most of the ore and vein matter is found.

"The porphyries have broken up and followed, as a rule, the stratification of the blue limestone. It must be remembered, however, that there are local exceptions to this rule in both sheets, forming the most indisputable proofs of the igneous origin of these rocks. The main sheet is the white porphyry, which lies on top of the blue limestone and forms the outcropping rock over the entire upper portion and eastern slope of the hill. Between the Morning and Evening Star it ceases about 300 feet from the foot of the claims. Thence the outcrop of its apex takes a northerly course for about 400 feet, and then, turning more and more towards the northeast, it follows, approximately, a contour of the hill to Stray Horse Gulch.

"Below the white porphyry, and, except for a few hundred feet from its outcrop, below the blue limestone also, there is a second and distinct sheet of porphyry, the gray porphyry, beneath which the ore of the much-noised second contact is found. The gray porphyry follows a horizon between the blue and the white limestone from the east to a point about 150 feet west of the McHarg shaft. Here it suddenly takes a much steeper dip, and, cutting across the blue limestone stratum, outcrops below the Morning Star and Henriette properties somewhere in the lower half of that formation.

"There are still many in Leadville who doubt the existence of this second sheet of porphyry. It may, therefore, be advisable to discuss this subject a little more at length, and to state some of the numerous facts which prove its existence. The writer stated in the Chronicle, in the fall of 1882, his reasons for believing strongly in it. Since that time further development has strongly confirmed that belief. As nearly as he can remember the more important points there brought forward were: (1) The gray porphyry has an entirely different appearance. It is of the variety locally known as bird's-eye porphyry, having a coarse, crystalline texture. This texture arises from its having a different composition from the white porphyry, being much less acidic, having more feldspathic constituents, and therefore more easily fusible, and having had more time to crystallize. The white porphyry, in contrast, has a microscopic rather than a macroscopic texture, though a much thicker sheet. (2) Overlying the gray porphyry there is alway a sheet of unaltered blue limestone, having the normal southeasterly dip, and beyond doubt in place. The white porphyry, since it always overlies the blue limestone, could only have some of the Upper Carboniferous strata above it. (3) Starting from the outcrop, the gray porphyry had (at that time) been traced 150 to 200 feet beyond the apex of the white.

"On the supposition that there was a second sheet of porphyry, and that the ore-chute of the Lower Waterloo and Henriette was under it and east of the alleged carbonate fault, the Evening Star upper shaft, the now well-known McHarg shaft, and the Henrietta upper shaft were all sunk to penetrate it. The McHarg shaft, after passing through 10 feet of wash, entered white porphyry, and, after passing through 180 feet of this rock, struck vein matter at a point 15 feet above the corresponding point in the neighboring Morning Star main shaft. The vein matter was highly ferruginous. Assays of the best of it gave as high as 7 ounces and 14 per cent. As the shaft is too far north of the main ore current, no pay ore was struck. Two hundred and seventy-five feet below the surface the vein matter disappeared and limestone was entered and lasted for 65 feet. At this point the gray porphyry was struck, and, after passing through 55 feet of this rock, 2½ feet of heavy carbonate of lead was developed at a depth of 395 feet below the collar of the shaft.

"Sinking was begun from the old bottom of the upper Henriette shaft, just below the east end line of the claim, during the fall of the present year. The vein matter ceased and solid limestone was entered at 400 feet from the surface. Gray porphyry was struck at 445 feet, and the contact reached at 505 feet. Owing to a rapid increase in the amount of water in the shaft, development on this contact has been for the present abandoned.

"The Evening Star upper shaft, prior to August, 1882, had a depth of 308 feet, of which the upper 300 feet were in white porphyry. At that point sinking was resumed, but after going 100 feet they had to stop on account of water. Early in December, 1883, sinking was resumed, and at a depth of 415 feet gray porphyry was entered, and at the present writing it has been penetrated about 18 feet.

"On the Morning Star property the ore has been followed on the second contact from its outcrop to a point over 100 feet beyond the McHarg shaft, or over 450 feet beyond the apex of the white porphyry. The Henriette has gone much further east than this, but the white porphyry also ceases somewhat further to the east on that claim than on the former.

"All three of the above-described shafts are on the upper portions of their respective claims. All show the gray porphyry continuous thus far into the hill, and no shaft yet sunk has disproved its existence. Further, there is evidence of the second sheet below the white porphyry on Iron Hill, above the iron fault. How, then, after accepting the definition of a double contact, can the existence of one on Carbonate Hill be denied?

"There yet remains to be said something about the carbonate fault. Developments during the past eighteen months have shown conclusively that no fault of more than 20 feet crosses either the Morning or Evening Star properties, nor the Henriette, 1,200 feet below the east end of that claim. The fault, if it exists on this part of the hill, as it indisputably does further south, must be further west. It seems to the vriter more probable that on this part of the hill the carbonate fault ias merged into an anticlinal fold, and that the top has been worn away y erosion; that the outcrop of the various formations marks the cap f this fold, and that further west the same strata and the sheet of white orphyry exist, now dipping west or southwest instead of southeast."

The Henriette and Maid of Erin mines.—The Henriette mine is one of he apex locations of Carbonate Hill. It has four shafts, the first at the nouth of Big Stray Horse; the second, known as the Harkei shaft, is he main working shaft at present. It is 200 feet down at the second ein, the first being only 15 feet beneath the surface. The third shaft is 00 feet from the first; the third shaft, a few hundred feet east, has been unk 350 feet and is used as an air shaft. The fourth is called the up-er Henriette, located on the line of the Maid of Erin. Before we enter he mine let us inspect.

A little distance from shaft No. 3 the incline shows an 18 inch body f solid lead sand, which gradually widens and exposes for several hun-lred feet in length an almost uninterrupted body of the same ore. The reast of an incline some 680 feet from the shaft No. 1 shows a galena re some 4 feet in thickness, with indications of still further increase. This is 150 feet from the upper Henriette or Maid of Erin shaft, which vill strike it at the depth of 550 feet, the shaft now being 500 feet deep.

The mine employs only a few men on development work. The shipments in 1883 have averaged 800 tons per month. The galena shipments average 200 ounces silver per ton. This property is supplied with all necessary surface improvements, shaft and engine houses, hoisting and pumping machinery. A tramway leads from the shaft-house to the ore-house, which is rather a covered ore-chute than a house. The ore is dumped on to two screens, one for each side of the chute, and then falls into the receiving bins below, passing over another set of screens n its fall. By this arrangement the ore dumped on to it screens itself, depositing the coarse in the upper and the fine in the lower bin, where through smaller chutes it is dropped into the wagons.

The Morning Star Consolidated Mining Company is the owner of a group of mines which, with scarcely a single exception, are classed among the producers of the camp. The most prominent are the Morning Star and Waterloo.

The McHarg shaft-house, one of the finest in Leadville, contains a large engine, Colorado hoister, three boilers, and two steam pumps.

The Lower Waterloo has a Cornish pump, one steam pump, three boilers, one hoister, and an air-compressor; the Morning Star, a hoisting engine, one boiler, and a saw-mill; the Kitchen shaft, one hoister; all are covered with suitable housing.

There are besides numerous dwelling-houses, extensive shops for carpenters, blacksmiths, timbermen, and other structures necessary to the establishment.

In the Morning Star main shaft the work in progress consists of stoping on both sides of the main incline, which starts from that shaft at the level of 240 feet. These stoping grounds are 50 feet from the station. The hard carbonate streaks of the same are found containing considerable chlorobromide of silver, in large flakes, sometimes covering the whole fracture.

The McHarg shaft is worked on all sides around the shaft at the 410-foot level, a block of ore being left standing around the shaft to support the same. These workings yield about 35 tons a day.

There are two classes of ore, the one a very heavy lead sand, assaying from 65 to 70 per cent. lead and 16 ounces in silver; the other lower in lead but higher in silver. The latter is more silicious, which kind does generally exceed the pure lead sands in the contents of silver. Assays of this second class run up to 90 and 150 ounces. There is no gold in this mine to speak of. The lead sands from all the different shafts are shipped separately and apart, but all the hard carbonates are mixed and brought up to a paying silver grade.

The Kitchen shaft, of which the last 20-ton lot shipped returned 300 ounces of silver per ton, is still showing the same streak of chloride, and which is widening occasionally into good-sized pockets. The rim of this ore is being followed toward the Evening Star line.

The Forsaken has been connected by one continuous stope with the McHarg shaft, and has done very well in 1883.

PRODUCTION, 1883.

| | Tons. |
|---|---|
| Ten months, net | 10,288 |
| Two months, estimated | 2,057 |
| Total | 12,345 |

Average, 20 ounces of silver and 34.20 per cent. lead.

PRODUCTION, 1882.

| | Tons. |
|---|---|
| Twelve months | 19,060 |

Average, 30.25 ounces of silver and 38.33 per cent. lead.

The Evening Star, the twin sister of the Morning Star, has a good record, and its shipments of carbonates, from a far more limited extent of territory than the Morning Star, have been astonishing.

The upper Evening Star shaft-house holds a 10-inch pump, one hoister, one engine for the pump, and two large boilers; the main shaft, one hoister, one boiler; the Rawworth shaft, one hoisting engine; shaft No. 5, one hoisting engine; the Forsaken, one baby hoister. All provided with good shaft-houses, dwellings, office, boarding-houses, and carpenter and blacksmith shops.

The upper Evening Star shaft is being sunk deeper, bound for the second contact. It is now 430 feet down, and in gray bird's-eye porphyry, just the very same rock which was struck between the first and second ore-chutes in the Maid of Erin and also in the drift of the Colonel Sellers lease.

Regarding the workings, an idea can be had from the review of Professor Ricketts given heretofore.

The following record of the Evening Star may be of interest:

| Years. | Tons. | Ounces silver. | Per cent. lead. |
|---|---|---|---|
| 1879 | 1,980 | 54.80 | 22.90 |
| 1880 | 6,200 | 49.30 | 25.00 |
| 1881 | 15,625 | 50.80 | 28.40 |
| 1882 | 27,618 | 43.30 | 21.50 |

The Niles Augusta mine, just below the Evening Star mine, is worked by lessees. Operations were begun early in March last, and, after a great deal of exploration work was done, an ore-body of low-grade iron was discovered to the northeast of the Augusta shaft. Scarcely had the extraction of ore begun when it was learned that the iron-body, in which a fair stope of pay ore had been opened, was on the territory of the Evening Star mine, and had to be abandoned. Not discouraged, however, the lessees resumed exploration work, rising to a higher level in the mine, and gaining the top of the iron ore. A drift was driven southward from the Augusta shaft, and in a short time fair streaks of ore were encountered. Continuing on these streaks to the southwest but a very short distance, the mineral opened out rapidly, and now shows a face of ore 2 to 6 feet in height and about 15 feet in length. The ore is a black sulphate of lead, gray and brown sand, and yellow ocher.

The Glass-Pendery mine, which consists of two claims on Carbonate Hill, formerly known as the Glass and Pendery, was organized in 1879. Very high-grade chloride ores were discovered in the Pendery, and from their proceeds a dividend of 10 cents a share was paid. Since then—that is, for the past four years—the mine has not been profitable. This year a small force of men has been kept at work, but not much ore has been shipped. The output has been about 10 or 12 tons a month of chloride ore, worth from $200 to $400 a ton.

The Crescent mine has been meeting with some success since the property was leased. After securing the lease new shafts were commenced at the extreme lower or western end of the claim, and at 24 feet from the surface an ore-body was struck having a thickness of about 42 inches, assaying 25 ounces silver and about 40 per cent. in lead. In the old workings the ore is a sand carbonate of a very good grade, in addition to large bodies of iron ore.

The Catalpa has been producing pretty regularly during the year, the output being the result, mainly, of tribute workers. Considerable exploration has been made on this property in every direction. The eastern incline was run 585 feet from the main shaft, disclosing strong stringers of fair ore that averaged 13 ounces silver and 40 per cent. of lead.

The Yankee Doodle, on Carbonate Hill, the property of the Carbonate Hill Mining Company, continues showing considerable ore in sight. The product of this mine has continued steadily at about 175 to 200 tons of ore during the year. During that time a great many improvements have also been made, both on the surface and in the way of opening more avenues for working the mine and extracting the ore. The main incline has attained a total length of 1,150 feet, from which levels are run on each side. This incline shows good work, being excellently timbered and laid with T-rails, as also the levels, the lowest being driven 1,000 feet from the mouth of the incline. At the head of the incline is the hoisting plant, which has the capacity of hoisting a loaded car of ore at the rate of 900 feet a minute. The mine has nearly exhausted its large bodies of high-grade sand ores, but still shows large resources in low and medium grade ores.

The Ætna mine is the property of the Meyer Mining Company. It is developed by seven shafts that aggregate 865 feet; two inclines, 275 feet; and 7,000 feet of drifting. The ore is an excellent fluxing ore, and carries from 2 to 10 ounces silver per ton. The ore-body is from 20 to 80 feet in thickness, extending over considerable ground.

The Leadville Consolidated Mining Company own the Carbonate and Little Giant claims. The Carbonate claim is the most extensively developed, and from its ore-bodies has come the " wherewith" to pay the regular monthly dividends. New pockets and stringers of ore have lately been opened much faster than the known old ones were exhausted, and in consequence the resources of the mine are now more extensive than for some time past. The only failing point in the mine is the large pothole in the limestone under the main incline, between the second and third levels. This pocket was discovered nearly two years ago, and has since yielded a great many thousand dollars worth of ore.

The most extensive and productive ore-bodies in the mine at the present time are as follows:

At the foot of the Crane shaft, which is situated about 100 feet north of the engine-house. For some months past this pocket has yielded 20 to 30 tons a month of $100 ore. Another profitable ore-body is situated in the extreme northern end of the Carbonate claim. The largest ore-body in the mine is located near the junction of the south incline and No. 10 level. A large area has here been stoped out, and fine ore is left standing on all sides. A number of lesser ore-bodies are to be seen in various other portions of the mine, and a great deal of available ground is still left for prospecting.

The William Wallace mine, just east of the Yankee Doodle, has been working steadily during the year, but as yet no very large ore-bodies have been exposed. The shaft is 568 feet deep. The last forty feet of the shaft passed through black iron and contact matter. Water has caused much delay, but now this is handled by a 10-inch Cornish pump. Quite a number of drifts are being pushed in different directions from the shaft, and ore-stringers appear in some of the drifts.

The Big Chief and Castle View mines, property of the Big Chief Mining Company, just above the Morning Star, have developed very satisfactorily during the past year, and quite extensive new resources have been opened up. Running a southeasterly direction through their claims, about 40 feet east of the Big Chief shaft, is a porphyry dike, which cuts through the contact and ore. This dike has been pierced in several places, and each instance showed fine ore on the eastern side. The first drift driven through the porphyry wall, which had a thickness of about 60 feet, is located but a short distance south of the Big Chief shaft. Passing through the barrier of eruptive rock, and striking good contact, a winze was sunk, disclosing 30 feet of fine-looking ore, assaying from 12 to 25 ounces in silver to the ton. This success induced the owners of the Big Chief to drive another drift to the east, starting from a point near the Castle View shaft. This drift is about 150 feet in length, and at its face a winze down 25 feet shows 5 feet of ore and 20 feet of good iron. The ore runs 50 to 60 per cent. in lead and 6 to 10 ounces in silver, and is a fine gray sand. The iron also runs well in silver.

The Adams Mining Company was incorporated in December, 1883, and is a consolidation of the Saint Bernard and Brookland Mining Companies. Of this property the Leadville Democrat says:

"The property of the company consists of the Clontarf, Brookland, and Moynamensing mining claims, all three of which are proven to contain valuable ore deposits. The two former are located on the Carbonate Hill, the latter on the Yankee Hill contact vein. The Clontarf and Brookland carry the demonstrated continuation of the celebrated Morning and Evening Star ore-chute; the Moynamensing the extension of the Matchless and Robert E. Lee chloride ores from East Fryer into the Moynamensing claim, as also into the May Queen and Forest City, which two latter claims owe their present prosperity to the first strike of this precious chloride ore in the Moynamensing.

"The Clontarf and the Brookland are provided with extensive shaft houses and from 25 to 50 horse-power engines, four in all, for hoisting, and for drainage by two 10-inch Cornish pumps. The Moynamensing, with shaft house and baby hoister.

"The Clontarf shaft is 510 feet deep, of which 10 feet are sump, the main and only level being at the depth of 500. The Brookland shaft is 545 feet down, 535 to the only level. The Moynamensing shaft is 90 feet deep.

"The Clontarf has been a regular shipper of considerable quantities of excellent lead sand all the past year. The sump of the shaft is in about 8 feet of solid carbonates; below it is iron through which the shaft is now continued. It is a favorable looking deep black iron, with some manganese. From the shaft one drift is progressing north toward the Brookland, another went 50 feet to the west line, then turning north along the line from which the sloping was done towards the other drift. All the drifting amounts to about 400 feet. And nowhere has the ore been found wanting or interrupted by worthless vein matter. From the shaft where the ore, which lies immediately under the porphyry, rises with the contact to the north, to the breast of the main north drift, it is one continuous harmonious body of sand carbonates, partly chunky, partly fine sand, and measuring fully 9½ feet in the breast of the said drift. There is not a foot in all the workings where the ore has not been, or is not of the same uniform character and solidity.

"The ventilation is good, natural circulation, effected by connection with another mine.

"The north drift will be continued to the Brookland, in order to ease the latter of its enormous surplus of water. It is expected that by means of drift connection with the Clontarf the water will be more equally divided between the two. The Brookland has a drift in 12 feet of ore 25 feet in. It shipped about $14,000 worth of ore before the water became too strong. The ore produced in both mines is the same, and will average from 10 to 12 ounces in silver, and 40 per cent. lead, with very little silica. It commands a ready market at all times. Among the iron in the bottom of the Clontarf were found a few chunks of hard carbonates, the sides of which were covered with chloride of silver. There is every probability that this class of ore will also be met with in these mines in the same or similar quantities as in the Morning and Evening Star mines.

"Moynamensing is the seat of the first discovery of the large chloride ore chute of Yankee hill. It produced largely, and will so still as soon as some disputes with adjoining claims shall have been settled. At present it is not mined. The ore on this part of Yankee hill yields a minimum average of 100 ounces in silver."

The Wolf Tone and Agassiz Consolidation owns the Wolf Tone, Agassiz, and other claims on Carbonate Hill, adjoining the Brookland and Clontarf and Morning and Evening Stars. In all the property embraces about 22 acres. Only the upper stratum of ore has been worked during 1883, and this on lease. This stratum of ore comes almost to the surface of the ground, and is worked by shafts and tunnels. The deep Carbonate Hill vein is worked through the Wolf Tone shaft, which reaches the ore at 630 feet in depth, though the shaft is 704 feet deep. The Wolf Tone has not been worked this year, nor the lower workings of the Agassiz, on account of water which the company was unable to control. Considerable ore is exposed in the lower workings.

The Goneabroad mine, the property of the Borell Mining Company, is being worked by the representative of this corporation. The successful operations of the lessees of the Goneabroad mine last spring and summer resulted in giving the company sufficient money to pay a dividend and leave a surplus on which to work the mine. The present resources of the property are confined to large bodies of iron ore, with occasional pockets of chlorides. The first-class material has an average value of

$125 per ton, the second-class from $25 to $35 per ton. To facilitate the extraction of ore, new machinery was placed on the Goneabroad shaft, but the main workings are through a drift connecting with a shaft of the Cyclops mine.

The Humboldt Mining Company owns the Gold Leaf, Modest Girl, and Thistle lodes. A recent strike has been made in this property.

The Alleghany Consolidated Mining Company owns a group of five claims in the gulch just below the Lee Basin and Denver City. The ore is a carbonate, and but a very small amount has been extracted. The developments consist of five shafts with an average depth of 325 feet. The property is now well supplied with hoisting and pumping machinery and work will be continued.

In Stray Horse Gulch is the property of the Marion Mining Company. This property, which embraces the Cyclops, has been working during the year under a lease, and the output has been regular. The ore is a sand carbonate averaging 90 ounces silver per ton.

The following synopsis of Iron Hill is clipped from the New Year's edition of the Democrat:

"Iron Hill.—This is at present the champion ore producer of the camp, and bids fair to continue so for years to come. It is properly a continuation of Carbonate Hill, separated from it by depressions of Graham Park and a little gully opening into California Gulch. The mines and claims of Iron Hill may be classed as follows: Firstly, the apex locations; secondly, those on the dip of the contact in the rear of the apex locations; thirdly, those on the croppings of the fallen part of the contact; fourthly, the claims on the fall of the vein. The apex locations consist of the following mines: Little Daisy, Stone, Montgomery, Lime, Smuggler, Bull's Eye, Silver Wave, Iron, Iron Hat, Camp Bird, Pine, Adlaide, Terrible. Between the Iron Silver mine and the Argentine group a great break interrupts the apex connection at or near the surface, and the displacement is so great that no pay-ore chutes have as yet been found therein, although there is little doubt that they will be discovered by operations toward their discovery. In our opinion, the ore will be found in vertical and anticlinal position in between the limestone. The claims covering this uncertain territory on the line of the apex are the Belle of Colorado, Charlestown, and Devlin.

"The mines on the dip of the vein behind the apex locations are the Gilt Edge, Col. Sellers, Minnie, A. Y., Ocean Wave, White Cap, Collateral, Forfeit, Star of Hope, Grand View, Cleora, Silver Cord, Rubie, Colorado No. 2, Louisville, Low Porphyry, Tuscon, Christmas Gift, Frenchman, Belgian, Humboldt, and the following claims: The Accident, Sierra Nevada, Horseshoe, Minnie Lee, A. P. Willard, Eagle, Idaho, Delta, and others.

"Nugget Gulch and Adlaide Park we mark as the eastern limits of Iron Hill. The locations on the fall of the vein are: Young America, Keystone, Cleopatra, R. A. M., Paris, Greenback, Chestnut, Walnut, Codfish Balls (produced some ore), Iron Queen, Oro, and Trio, Blind Tom, Nappert Andy, No Name, Satelite, Ida and Alice, Star of the West, New Era, Washington, Eveline, Hidden Treasure, Lone Tree, Singular, Globe.

"The locations on the croppings of the fallen part of the contact are: On California Gulch, the Garden City and Smasher. It is possible that the mineral-bearing vein matter of these two claims belong to the ore-body of the premises of the Emmet Mining Company across the gulch, and that it does not connect with the main body of the fallen part of the Iron Hill contact. The locations on the croppings of the Iron Hill fallen contact on Stray Horse, and belonging to the Small Hope group, have already been mentioned in our account of Carbonate Hill.

"The production of carbonate is and will remain for several years preponderating over that of sulphide, but in the course of time the latter will gain the ascendency."

The Terrible Mining Company owns the Terrible and Adelaide mines. Its existence dates from the reorganization of the old Adelaide Mining Company. By careful and economical working considerable ore has been shipped during the past year from the old workings, which contain many tons of concentrating ore, which can be easily and cheaply concentrated to advantage by common jigs. According to the manager's opinion, the main ore-chute has not yet been found, but a lack of money prohibits deeper explorations. The property is mostly worked by lessees, who have occasionally struck rich pockets of chlorides.

The Argentine Mining Company owns a group of five claims just below Adelaide mine, and reach back over the brow of Iron Hill. After an unsuccessful campaign of several months, the company decided to lease its properties, and half a dozen parties are now engaged in working different portions of the old Gallagher mine.

Mr. W. R. Chadbourne, the representative of the company, has taken a lease in the Last Chance shaft, and is working at a depth of 100 feet. Mr. Chadbourne thinks that there is a possibility of finding ore in the upper limestone contact, and is now engaged in prospecting this zone, which the company refused to do.

Mr. Riley and others have faith in the northwestern portion of the Keystone claim and began sinking a shaft on it. The point selected is west of the break, about 100 feet northwest of the Devlin shaft, and a depth of at least 300 feet will be required to reach the line of contact.

Mr. Barnes and others have a lease a short distance south of the entrance of the Argentine tunnel. A shaft has been sunk to a depth of about 90 feet and a promising contact disclosed.

On the line of outcrop two other shafts have been sunk by different parties. One of these is down 25 feet, and has pierced a 9-foot body of ore. Two assays have been made on the mineral, returning respectively 6 and 24 ounces in silver to the ton; also, 6 per cent. in lead.

None of the old workings of the mine, which are very extensive, have been leased.

The Iron Silver Mining Company has been one of the largest producers in Leadville since 1878. It included nine claims, extending over a mile in length, and stretched nearly from Stray Horse Gulch on the north to California Gulch on the south. They were the Iron, Iron Hat, Porphyry, Dome, Rock, Stone, Lime, Bull's Eye, and Law. Since then the company has purchased the Luella, Tucson, half of the Moyer placer, and other properties, making its mining estate the largest in Leadville. Of this company the Leadville Herald reviews as follows:

"The Iron Silver Company.—The properties of the Iron Silver Mining Company are all being improved both by surface and underground additions. As is reasonable to suppose, in mines where so much ore is extracted as from those of the Iron Silver Group, new development and exploration has always to be carried on, and with them follow new surface additions, no matter how complete the old plant may have appeared. It is therefore not in any single place on the company's property that new work is in progress, but all along the line of outcrop, from the Iron Silver mine on the north to the Stone mine on the south. This, however, is not altogether sufficient, for with depth new working avenues have to be provided, and among this character of work is the Moyer shaft, situated back of the Stone mine.

"At the old Iron mine the usual number of miners are employed, and the regular average output of 75 to 100 tons a day is reported. The mine, while not showing any extraordinary resources, nevertheless maintains a fair amount of ore in sight. The ore bins at the mine, which are the largest in the district, are being repaired, raised slightly, and provided with a new roof.

"Just south of the south incline is the Old Whim shaft, and also the new McKeon incline shaft. Both these shafts are producing some ore, and the Old Whim shaft is yielding considerable fine mineral.

"The McKeon shaft, which follows the fault to the westward, is making but slow headway, awaiting provisions for better hoisting facilities. The new drum, on which the winding for this shaft is to be done, is situated in an annex to the main engine building, several hundred feet distant. It will be driven through an intermediate clutch from the main shaft of the one hundred and fifty horse-power engine, which also supplies the motive power for the other two drums and the saw mill. At the shaft a large triangular gallows frame has been erected, with supports on an incline with the shaft. The ore will be hoisted from the new shaft in self-dumping skips and thrown into cars, by the means of which it will be conveyed to the ore bins. A commodious shaft-house incloses the shaft. The gallows frame and skipway is a most complete and durable structure, and judging from its appearance the company has made preparations for sinking the McKeon shaft on the line of the fault to the next lower contact to the westward, a depth of probably 1,200 feet or more. The resources of the ground so far opened by the shaft have been satisfactory, and the work has more than paid for itself in its yield of rich ore. The ore is of higher grade than that found in the contact above, but occurs irregularly in pockets and bunches. The inclosing matrix is decomposed lime and oxidized iron, not unlike the contact matter of the horizontal contact. The Lime and other various properties of the company are still working on lease and producing handsomely.

"The next point of interest is the Moyer shaft, in which a new strike was reported. The shaft is 600 feet east of the workings of the Stone mine, and was sunk to prospect the extension of the Stone ore-chute. It is situated on territory known as the Wells and Moyer placer, and also belongs to the Iron Silver Company. The shaft is down a trifle over 300 feet, from which a drift was driven to the northwestward. At 30 feet from the shaft ore was encountered, and the shaft was then continued to the Colonel Sellers line, and then driven a short distance further northward along this line. Up to the present time the drift has a length of fifty six feet, and with the exception of the first 10 feet is all in ore, top, bottom, and sides showing nothing but mineral. Near the porphyry, or top of the ore-body, the mineral is a fair galena ore, carrying some sulphate of lead, and only small quantities of iron pyrites and zinc blende. As the drift advanced into the heart of the ore-body the mineral became more refractory. Analyses of the ore are now being made, and a 50-ton lot will be shipped to the smelters in a few days for a test run. The ore, doubtless, like that of the A. Y. and Colonel Sellers mines, will be found of very fair grade in some places, while other portions of the ore-body, again, may prove entirely valueless. Until tests have been made on a large scale, very little can be said on this subject. The drift striking the ore approached the chute from the south and near the top, leaving a strong body of mineral back below the drift, as well as presenting an unbroken face ahead. The general course of ore-chutes in this section being toward the northeast, it is reasonable to suppose that the present work is cutting the ore-trend at right angles, in which event it will prove one of the strongest ore-bodies yet opened.

"In order to open the new ore-body properly it was necessary to sink the shaft to greater depth, which has been found impossible on account of water. In consequence, another large steam-pump has been ordered. In the mean time a station is being cut for the reception of the pump, and other preparatory work advanced.

"At the Stone mine work is advancing about as usual. Ore is being hoisted from four different shafts, and the yield of the mine on many days is greater than can be got away by the teams hauling the ore. The lessees on the Rock and Dome mines are also doing quite well, and shipping considerable ore."

Regarding the Silver Cord combination, the Leadville Democrat speaks as follows:

"The combination comprised a territory of over 30 acres, consisting of numerous claims to-wit: The Silver Wave, Silver Cord, Cleora, Delta, St. Theresa, Holy Terror, Minnie Lee, Eagle, Ottawa, A. P. Willard, and south half of the Rubie, the east half of the Bull's Eye, and some minor fractions. All persons familiar with the great Iron Hill contact are enabled to comprehend the great value of these premises. The combination occupies 1,500 feet of the apex and over half a mile horizontal measurement upon its dip, thus considerable more on account of the dip of the contact.

"The surface improvements consist of the head-house of inclines, carpenter shop, and timber-house, which are frame buildings; then the sawmill, built of corrugated iron, the main engine, boiler, and tank-house of brick with iron roofs. Further, a blacksmith-shop, ore-bins with trestlework for dumping, two barns, three boarding-houses, four residences of manager and employés, the office with assay rooms.

The main incline has a length of 940 feet, and its size is 6 by 6 feet in the clear. Levels are run off north and south, and the cars in the levels drawn by mules. The cars are being taken to the ore-breasts loaded, and sent direct to the ore-bins. At the station an average of six cars are formed into a train which is sent up the incline. The incline is lighted with local lamps when the mine is shipping. At present, with the mere developement work in progress, the incline is not lighted. It has a single track of 12-pound rails, and a gangway the full length. All signals are made by electricity. There is also a safety-rope for signaling in emergencies in between the stations. The natural ventilation of the mines is perfect. The workings northeast of the head of the incline are being driven onward without intermission. It has thus far been crossed diagonally by three ore-shutes, which run northeasterly, while the course of the incline is due east. When the mine is worked to its capacity, these chutes are being mined through inclines, levels, uprises, and winzes connecting with the main passage, substantial sets of timber replacing the ore bodies removed from these troughs.

"The main incline is driven in the limestone, the present breast being about 90 feet under the contact, which is explored from the levels, and where mineral is discovered the same can be mined with so much greater facility. This position of the incline below the contact had become absolutely necessary, because the most and best mineral was and is found in troughs in the limestone connecting with chambers of great extent and crevices and pipes of great depth. The present operations of the company is being confined to the aforesaid driving of the main incline and exploration work in an east-northeasterly direction to the Rubie shaft. Turning from the main incline into the well-known gold-ore chute, which, to its breast, as far as opened, exposed 36 feet width and 17 feet height of this ore. It is a yellow, ochery, dry ore, with little lead, but from 1 to 1½ ounces in gold and 6 ounces in silver. It is never shipped by itself, but mixed with the more specific lead carbonates. Some large stringers of hard lead carbonates and lead sand intersect and line this gold-ore chute. Turning due north, a large body of low grade and silicious hard carbonate is met, which proves a separate trough between the aforesaid gold-ore chute and chute No. 3. At the present breast of the gold chute this middle chute spreads and connects with the two others. At the junction the mineral is uniformly good; No. 3 especially opening into a large chamber with pipe, which is just being explored by winze, and shows there is no end to the mineral—a good lead sand. There is exposed fully 35 feet of this ore, its exact width having as yet not been proved, but estimated at 28 feet. The distance of these workings from the Rubie is about 450 feet. The Rubie workings include a fine breast of mineral on the Minnie Lee side, and a 20-foot body, if not more, in an extensive pipe vein, still nearer to the Silver Cord workings. All these bodies belong to the Silver Cord combination.

"Returning through chute No. 3 to the main incline, the incline driven underneath No. 3 has opened up large and excellent ore deposits in the lime, and underneath old drifts and stoping-grounds. The connection of the main incline with the Rubie will be affected by a level after said incline shall have been driven 150 feet farther. The output from the Rubie will then pass up the incline. At present the total force employed does not exceed twenty-five men, and no ore whatever is mined which can possibly be left standing. The present production of about 20 tons is caused by the winze in the northeast workings being all in ore. As soon as its extent is ascertained it will be left untouched."

The property of the Smuggler Consolidated Mining Company, situated on the southwest side of Iron Hill, is hemmed in by the Iron Silver, Silver Cord, and Iron Hill Consolidated mines. It is a small piece of territory, but has been producing for some time. This property is worked under a lease. The ore ranges in value from 40 to 60 ounces silver per ton, and contains from 35 to 50 per cent. of lead.

Of the Iron Hill Consolidated Mining Company the following is taken from the Democrat:

"The properties of this company are situated in the California Gulch slope of Iron Hill—bounded on the west by the Collateral, Stray Horse, Smuggler, and Lime, on the north by the Silver Cord combination, on the east by the A. Y., and on the south by the Stone mine, all of these surrounding mines being among the heaviest producers in the camp. The different mines constituting the property of the consolidation are the Forfeit, with the Ocean Wave, Little Missouri, and Norman Boardman, the White Cap, and the Imes. The first-named five claims lie together, partly upon each other, in a compact group; the Imes cuts into and over about 5 acres of ground of the Silver Cord combination. It also cuts into two halves, from side line to side line, the Smuggler, taking from it about 300 by 300 feet. All the mines of the consolidation are patented. Fully two-thirds of the territory have never yet had a pick stuck therein. Whichever way one may go from these grounds, one cannot help running into a large mine, all situated either upon the apex or the dip of the contact of Iron Hill. The dip is northeast into

Nugget Gulch, the wealth of which is already proved by the Ruby and others.

"The territory of the Iron Hill Consolidation comprises 21 acres, 14 of which are virgin ground. Of the other about 2 acres are apparently exhausted of shipping ores, but still containing vast bodies of concentration ore, to which we shall again refer below. The remaining 5 acres are being worked at present for ore extraction and development by leads, cross-cuts, winzes, and upraises.

"The Forfeit shaft and engine-house on the southwest corner of the company's grounds is furnished with a 20-horse-power engine. The White Cap shaft and engine-house with a 50-horse-power engine, double hoister—a fine piece of work by F. W. Davis, of Denver, and placed by W. Pemberthy. The Imes shaft and engine, with a 25-horse-power hoister. In addition to these there are the necessary blacksmith and carpenter shops, timber and ore sheds, tramways, &c., but all within the limits of economy.

"Depths of shafts. Forfeit, 168: White Cap, 340, first depth, and Imes, 700 feet perpendicular through intervening level and the wings.

"Levels. The Forfeit will be connected in a few days by an upraise with the White Cap, the raise being 83 feet; total length of Forfeit lead to White Cap raise, 735 feet along the east line. This same level also connects with the old shafts of the Norman Boardman and Little Missouri, which small fractional claims are falling into oblivion, as they are now considered incorporated parts of the Forfeit. The same is the case with the Ocean Wave, a larger claim. All these fractional claims were purchased by the Iron Hill Consolidation and pass as Forfeit premises.

"The White Cap main leads radiate from the shaft. One branch runs in a southeastern direction 165 feet to connect with Forfeit upraise, another 300 feet towards the second ore chute, which was followed with eminent success by the Smuggler into the Iron Hill Consolidation. These incursions were stopped in October last. The northwest lead is 375 feet long, at the end of which it encountered the ore bodies which are now being developed and mined and form the No. 3 ore chute. This has been and is being followed by an additional length of level of 370 feet, the course of the latter being east of north.

"The Imes's main lead is 130 feet on the contact, northerly, and then southerly for the purpose of connecting with the northwest end of the White Cap, about 140 feet, which junction will have been effected before the publication of this report. At the point of the elbow of the north lead another runs 75 feet northeast, and still another the same distance northwest.

"The Forfeit has been explored and mined by 2,500 feet of levels, winzes, and upraises, and about three-fourths of an acre of stoping between the contact, yielding an abundance of desirable smelting ore, very high in lead and an average of 8 ounces of silver. In between the winzes and stopes patches of this lead sand are still being mined, and enormous quantities of low-grade, too low for direct shipment, but excellently adapted for concentration, are surrounding, intervening, covering, and underlying the stopes. This concentration matter will average 17 per cent. lead and from 3 to 4 ounces in silver. West of these old workings is about 1 acre of virgin ground, but already touched and proved by border incursions of kind neighbors from adjoining claims.

"The White Cap has three stations with about 3,000 feet of levels, winzes, and upraises, mostly exploring work necessitated by the change in the position of the contact which dips at an angle of about 20° in a northeasterly direction. The ore chute towards the Forfeit is in due position, but towards the northwest and the Imes' shaft it is covered by a layer of limestone, varying from 20 to 25 feet in thickness, the ore lying thus in a channel of lime, which, in fact, surrounds it. It is evidently a water course. We examined this ore chute very carefully. It varies in thickness from 1 to 8 or 9 feet, with occasionally very regular and extensive chambers of mixed soft and hard lead carbonates, sometimes separated in the middle by a calcareous talc a few feet in thickness. In other parts, where the channel is smaller, the lead sand is thinner and is underlaid or covered by a pure sandy iron carbonate, which for a long time was not considered of any value, as it is low in lead, until assays of the same gave surprising results of silver and gold value. A good deal of this soft iron carbonate will mill from $35 to $40 in gold and silver. This class of ore is now being mined and mixed with lead carbonates, the combination making a good fluxing ore and very marketable.

"In the Imes, long and persisting prospecting in the contact failed in the discovery of any pay ore. About eighteen months ago a crevice was found in the lime, followed to a depth of 260 feet, where pay ore was encountered, but had to be abandoned at that time owing to an excess of water. It was then resolved to prospect on the contact, which, not giving the result expected, preparations are now made to re-enter the crevice. The present work consists of extending the upper level sufficiently to reach the lowest workings in the crevice by a straight winze. Although relatively undeveloped, the situation of the Imes in the very midst of paying mines upon the dip of the Iron Hill contact, marks it as one of the most promising properties."

There are one hundred and seventy men employed at these mines.

Of the A. Y. mine the Leadville News says:

"The A. Y.—This well-known mine, one of the oldest in Leadville, was located in July, 1876, by A. Y. Corman and others, and passed into the hands of its present owners, Mr. Samuel Harsh and associates, in 1879. It consists of one full claim, patented. The first shipments were made in July, 1880, and in the following month regular shipments were begun, though the work was seriously hampered by water, and at times the miners were forced to suspend operations. Still, notwithstanding all drawbacks, the owners continued to market something like 200 tons a month in the last four months of 1880. In 1881 and 1882 the output did not vary much from 50 tons a day. In 1883 the shipments have been 9,284 tons. There are in the bins about 500 tons of sulphide ores, all sorted and ready for shipment, but the amount of carbonate ores in sight is not as large as at times it has been. The mine has no contracts out with smelters, and can afford to wait for better prices for lead.

"The ore of the A. Y. is of two kinds—carbonate ore, which for this year has averaged 21 ounces in silver and 21 per cent. in lead; and sulphide ore, of which the last shipments ran from 50 to 66 ounces in silver and from 15 to 33 per cent. in lead. There are three shafts on the property—No. 1, 166 feet deep; No. 2, 165 feet deep; No. 3, 350 feet deep. Of drifts there have been about a mile in length run since the mine was first opened. For the working of the property a very complete plant has been erected. The pumping apparatus consists of four oil-well pumps driven by a 25-horse-power engine, and these keep the workings completely dry. In No. 3 shaft an air-compressor is kept steadily running. The force of men employed varies. At times this year one hundred men have been on the pay-roll. Just now, as shipments are light, the force will not exceed twenty-five or thirty men."

The Collateral mine in California Gulch has been a regular shipper during the year. The ore is a fine lead carbonate, and runs about 35 ounces silver and 40 per cent. lead per ton.

The Colonel Sellers and Accident mines.—The following was received from one of the owners, who remarks that it is a good description of the property:

"The territory of the Colonel Sellers firm of undivided interest-holders consists of two claims, the Colonel Sellers and the Accident. They are surrounded by the Silver Cord combination on the north, the Minnie on the east, the Helen and Gilt Edge on the south, the Sierra Nevada and the Moyer placer on the east; the south 200 by 600 feet of the Sellers and Accident is leased, and is known as the Colonel Sellers' lease; the balance of the property is under the sole control of the firm, and managed by Mr. W. F. Patrick.

"The Colonel Sellers shaft No. 1 is covered with the following structures: Shaft-house, 35 by 75 feet, provided with changing-room for the miners; engine and boiler room, 20 by 24, a tank house, with a capacity of 100 barrels, supplied by the Ore-Iron-Hill pipe; blacksmith-shop, ore-sheds, and two tramways to loading platforms, one for first the other for second class mineral. The shaft at No. 2 has a small engine-room and shaft-house. The Accident shaft, another building of similar size. The Lessee shaft, a commodious shaft and ore-house, with engine-room. The workings consist of shaft No. 1, well timbered and partitioned, 405 feet deep, 265 feet to mineral, 305 feet to bottom of the mineral, 100 feet in porphyry below. Shaft No. 2, 265 feet to mineral, and 55 feet in the same, said to be high grade in silver and lead, but was not visible, as the shaft is being retimbered, 4 by 8, in the clear, sawed timbers, which work has just reached the top of the vein. The Accident shaft, 290 feet deep, may strike the vein at any time, but as the vein pitches in that direction, an additional unknown increase of dip may make the distance 400 feet from the surface. The Colonel Sellers lease shaft is 212 feet deep, 12 feet of sump, 200 to the first and only station. Between Nos. 1 and 2, 123 feet apart, connection has been established, starting from the 305-foot level of No. 1, with the ore-chute all over and around, as shown by some stoping, the vein dips to the east with a slant to California Gulch, and when it reaches the No. 2 shaft the contact of the porphyry and the mineral strikes the shaft on a level with the drift. According to this, the ore-chute, which will average 30 feet in thickness, dips to the east 30 feet in 123, and increases considerably in thickness; towards the northeast considerable stoping has been done from the station of No. 1, about 75 feet in length and 50 feet in width, but no clean stoping for that, and it exposes to so much greater advantage the almost uninterrupted solidity of the ore in this enormous chute. Here and there a few feet of square or rounded patches of porphyry constitute the sole interruption. At the northeast end of the stoping ground a drift is being run horizontally in continued northeastern direction, which has passed through the afore-described ore-chute and is in limestone, but the latter contains a good deal of mineral and shows particularly well in the breast, about 50 feet in. The main chute of ore lies about it.

"The south drift toward the gulch is 185 feet long, all in ore, mostly of a lower grade, as it passes through the upper part of the vein. About 30 feet from the station, and a little to the east of the south drift, a winze shows the better ore to be 24 feet thick below. About half way in t drift a cross-cut to the Minnie line cut 4 feet into that claim, leaving ore in the breast thereof. At the end of this south drift of the Sellers No. 1 a winze connects the workings with those of the Colonel Sellers lease. Over this winze a porphyry roof makes its appearance. As already stated, the lessees sank 212 feet and at the level of 200 feet ran a drift into the hill 100 feet through forest rock and some birds-eye or coarse grain, slightly decomposed porphyry, then through 20 feet of conglomerate, with clay seams and streaks of mineral, then into limestone. Several drifts now opened show the ore here to average 20 feet in thickness, running very well in lead, but not so high in silver at this part of the workings. We suppose the character of the ore will change here as it did above. The total extent of exploration on the Sellers claim proves a continuous ore chute from within 150 feet of the south end line to shaft No. 1, and beyond to the end of the stopes, where the ore extraction continues in a breast of ore all around, and a width of 123 feet from shaft No. 1 to No. 2, and a minimum thickness of 24 feet of merchantable ore.

"The Ruby mine.—Situated on the east side of Leadville, in a line with the strong ore bodies of the Silver Cord and Iron-Silver mines, is the Ruby mine, on which work was commenced in the winter of 1879. During the summer three-fourths of the property was sold, the original locator of the property retaining a quarter interest with the new owners. The new owners have been working steadily to develop the property, and have made a number of new discoveries. The most important strike, however, was made in prosecuting work on the mine a short time ago; a body of ore was opened, 50 feet in length, 20 in height, and 15 to 20 feet in width, which runs well in silver and lead, and also carries from $4 to $10 in gold to the ton.

"The shaft of the Ruby mine having been sunk to a considerably greater depth, a drift has been started to the eastward, which, at a distance of 50 feet from the shaft, is expected to intersect the ore body in its easterly dip. Work is also being prosecuted on a west drift, which has attained a length of about 200 feet, and is now only about 100 from the Louisville line. This drift will be advanced without delay to the western end line of the claim, 600 or 800 feet further on. So far the mine has shipped but limited quantities of ore, all efforts having been concentrated in the attempt to more thoroughly explore and develop the mine's resources.

"Rock Hill.—The results of mining operations on Rock Hill during 1883 show an increase of production and some new developments. We understand by Rock Hill all that portion of the divide between California and Iowa Gulches which holds mining locations on the continuation of the Iron Hill contact. The apex of the latter crosses California Gulch on the Daisy and La Plata mines, continued by the Seventy-Six, Rock and Dome, and a corner of the Pinnacle, then disappears beneath wash and a porphyry dike, and comes again to the surface in rather sore plight on the Nisi Prius and Pease placers, in Iowa Gulch. On the dip of the vein lie the Crown Point and Pinnacle, also producing mines, and the William Reddick, H. D. Gruesen, El Dorado, and others in conflict with the Wells and Moyer placers. Upon the fall of the vein are the following mines: Oro City, Ben Burb, Robert Emmet, the Great O'Sullivan, Columbia, Vining, Only Chance, and Seguin, and some claims, as the Crescentia, Zulu King, Coon Valley, Bessie Wilgus, Summit, Snow Bird, and some in Iowa Gulch."

The La Plata Mining and Smelting Company owns the La Plata mine. During the year a new shaft in the center of the claim has b sunk 250 feet deep to tap the ore body found running in limestone 95 to 100 feet below the contact. From the bottom of this shaft is a drift run some 250 feet, disclosing a large body of ore. In addition to this drift about 850 feet of drifting have been done in other portions of the mine. The principal workings are through a main tunnel 1,200 feet long. The ore is a fine sand carbonate, carrying from 15 to 30 ounces silver per ton and about 40 per cent. of lead.

The Crown Point and Pinnacle mines are worked by lessees. Development work mostly has been done, and but a comparatively small proportion of ore exposed has been extracted. New machinery and surface improvements have been erected.

The Oro City is developed by a tunnel 580 feet long and a shaft 250 feet deep; 500 feet of drifting runs from the tunnel, and four cross-cuts from the shaft, each 75 feet. All these workings show good stoping ground. The ore is a carbonate, carrying from 30 to 50 per cent. lead and from 12 to 25 ounces silver per ton.

The O'Sullivan mine has a tunnel 500 feet long and a shaft 140 feet deep. There are about 800 feet in drifts and cross-cuts that expose large bodies of sand and hard carbonates that average 5 feet deep.

The Argent Mining Company owns the Vining mine. During the first half of the year the shipments averaged 5 tons per day, and on account of several new developments the shipments were doubled. The ore is of two classes, the first netting $30 per ton, the second class ranges from $18 to $20. The principal ore body of the mine is to the southwest of the shaft. The present developments show a breast of ore 20 feet in width, 8 feet in height on an average, and opened for a distance of 30 feet. The developments by no means define the limits of this promising body of mineral. In the workings west of south of the shaft an uprise discloses a second promising body of mineral. Other portions of the mine also show ore in limited quantities. In the eastern workings a winze sunk to a considerable depth shows excellent prospects of ore in the near future. The winze has followed a crevice in the limestone, has encountered several natural caves, and is now penetrating a mass of iron and ocher of very encouraging appearance. The mine gives employment to about thirty-eight men, and is working at an expense of about $4,000 per month.

The Seguin mine, between the Crown Point and Vining mines, has been extensively developed, and about 2,662 feet of work is the result. The shaft, 512 feet deep, strikes the vein at 420 feet. At this depth are about 800 feet in winzes, uprises, and drifts. At the bottom of the shaft are two levels run in dead ground, each about 300 feet long, when the vein is again encountered and about 500 feet of development work done here. The vein is very strong, averaging 8 feet thick. It lies at the plane of contact. The hanging wall is porphyry, and the foot wall dolomite sand, with the exception of occasional pockets of gray sand and hard carbonates. The ore is low grade.

The Gilt-Edge mine, owned by the Elgin Mining and Smelting Company, is in California Gulch, and is one of the largest producers in that locality. The property is operated entirely by lessees.

On the Iowa Gulch side of Printer Boy Hill, the Nellie S., a relocation of the Legal Tender, created quite a stir last spring by its large and valuable shipments. The Brian Boru took another leap, but did not reach the shore. It is said to be better fixed at present. The Florence and the Ward remain the prominent mines of the hill. A good pocket was struck in the Oro Boy or G. M. Favorite, but legal proceedings between the two locations closed the mine down. The contact is exposed on the Northern Spy, at the head of the creek. The mining claims to which attention was drawn by the Nellie S. strike are: The Sangamon, Triangle, Wilson, Continental, Black Tail and Comstock (gold and silver producers), the Arcade, Kankakee, Now or Never, Altoona, Minnehaha, Sunny Side, Cave, Champion, and Fanny C.

Of the Nellie S. mine the Leadville Herald speaks as follows: "The limestone shows a general dip to the westward, with also a slight inclination to the southward. The blue limestone stratum shows numerous and abrupt corrugations. The ridges or rolls of lime have a general northeast and southwest course, and at the Nellie S. mine, in particular, seem to be slightly depressed toward the south. As the structure of the hill is followed to the westward, each succeeding lime roll is found lower down the hill. The sinclinals or troughs formed by the folding of the limestone are deep and contain the bonanzas of the mine. So far, the extraction of ore in the Nellie S. mine, has been confined to a single trough, which showed a width from the apex of the lime roll on the one side to that on the opposite of probably 100 feet. The first work done in the mine was on the eastern edge of the ore chute, which came out very near the surface, being covered by only a small quantity of bowlder-wash and slide-rock. To the east a lime roll cut out the ore, but to the westward it opened into a large body, which was explored and found to consist of shipping mineral clear across the trough until the next roll to the westward was encountered. In this space and working southward, which also is toward the surface of the hill, the bulk of the ore shipped was extracted. At this time there is still 2 to 6 feet of fine ore in the trend of the ore channel to the northeastward of the large old stoper, but the ore-chute appears to become more shallow as work advances."

The developments are being pushed with all the rapidity possible. The ore is low in lead and silver, but is enriched correspondingly in gold.

On the Brian Boru exploration and development work is being continued. The shaft known as the Kent shaft is sunk to a depth of 140 feet. Subsequently a plat was put in at 105 feet and a drift driven to the north about 40 feet, where a body of ore was exposed. The drift was there headed to the eastward and the ore body increased in strength. The mineral consists of a dark sand and light gray hard carbonates. The ore contains a great deal of lead, with some silver and gold. When hoisting machinery is provided this property will again begin shipments.

The Florence mine, consisting of two claims, the Florence and J. D. Ward, occupies the most valuable part of Printer Boy Hill. It has been a prolific producer of lead carbonates, running well in silver and gold, since 1878. A chute of truly immense size is now being opened in the very center of the hill. It is mostly a low grade hard carbonate, but in between the latter and the overlying porphyry are pockets and streaks of gold bearing talc, and several feet of fine lead sand. The size of the gold flakes in the talc is astonishing. The underlying sand carries some of it, and, joined to the silver, the whole makes a very valuable shipping ore. All the ore produced at present is stored in the extensive old stoping grounds.

The Pilot mine, on Printer Boy Hill, just above Oro City, has a tunnel 700 feet long. Two bodies of ore are exposed. One body is 2 and the other 4 feet in thickness. In addition to these ore bodies pockets of smelting ore are encountered which run well in silver and lead. The ore runs about $50 in gold and about $15 in silver.

Speaking of Breece Hill the Leadville Democrat says:

"This division lies between the Saint Louis mine, the Great Hope, Yankee Hill district, and Idaho Park, and between the heads of White Gulch (a branch of California) and Big Stray Horse. It is quite a large territory, with numerous developments, but as to pay there is only the Breece iron mine which has been producing sufficient in quantity, as well as value, to exceed the expenditures thereon. The Breece Iron mine produces nothing but iron, with a very high percentage of metallic iron and very little silver. There is no demand for it at present, as the Fryer Hill and Stray Horse mines yield a very good iron, with more silver than the Breece Iron. In 1879 and 1880 the excitement over the large bodies of sand and hard carbonates in the Highland Chief and Highland Mary caused a ready transfer of interests and much expensive prospecting, but the returns did not come. Immense quantities of Highland Chief ore were stacked for a long time around the sampling works of Eddy, James & Co. and other places. We suppose they have been used since, but the results were evidently not conducive to the further excavation of such ore. The number of claims is very large, and we limit ourselves to the enumeration of the following: Little Prince, Nellie Morgan, W. Penn, General Cadwallader, Benjamin Franklin, Des Moines, Little Annie C., Little Chippewa, Polar Star, Montana, Dyberry, Ohio, Widow's Mite, Wade Hampton, Hampton, Cumberland, Nautilus, Harry Colvin, Mabel Lee, Rising Sun, Champion, Victoria, Banker, Washington, War Eagle, Peoria Boy, Hartford Boy, Emma, Forest Queen, Ophelia, Watertown, Legal Tender, Golden Eagle, Edith, Dry Rock, Lady Jane, Iowa, Ballard, Pennsylvania, Denver, Highland Mary, Highland Chief, Aztec, Robert Burns, Idaho, Eclipse, Winter, Yates, Glengary, Drexel, Forest Queen, Emma, Little Mac, Clinton, Tribune, and Honeycomb. This is quite an army, and no commanders."

The Standard Mining Company owns the Saint Louis and Black Prince mines—the Saint Louis is a consolidation of what was formerly known as the Colorado, Prince, and Miner Boy mines. The ore is principally quartz, carrying gold which is found in veinlets ranging in width from 2 inches to 2 feet. The lower levels of the mine show an extensive body of sulphide ore, containing iron, copper, lead, zinc, silver, and gold. The mineral is quite refractory. The working tunnel is 730 feet long. Five shafts aggregate 1,141 feet. In drifts, levels, and winzes there are about 2,000 feet of development. A contract has been recently let to build a large concentrator for the treatment of the low grade ore, a new plant of machinery has been placed, and the property put in good condition.

The Mike and Starr Mining Company is still prosecuting work actively, notwithstanding the poor success that has attended exploration work for many months past. The working force of the mine numbers about eighteen men, and the property is worked at an expense of about $2,500 per month. The property of this company consists of the Mike, Starr, Tankerstown, Goodell, and Gardner Lodes. These mines are East and adjoin the property of the Silver Cord Combination. Developments consist of a shaft 500 feet deep, one level at 250 feet in depth is 550 feet long, and the level at 500 feet deep about the same length. The aggregate number of feet of development on this group is about 2,000 linear feet of drifts and levels, and about 1,000 feet in shafts. The Park mine, located in Adelaide Park, did not ship over 150 tons of ore in 1883. A new shaft sunk during the year disclosed, in December, a 4-foot body of mineral of good grade.

The Little Johnny mine shaft has a depth of about 120 feet, with two stations and levels at 82 and 112 feet, respectively, from the surface.

At the first level, a drift extends to the southward for about 50 feet, where a fine body of ore is encountered, possessing a thickness of nearly 4 feet. From this point an incline follows on the dip of the ore in a southeasterly direction for 50 or 60 feet, showing from 2 to 4 feet of fine sand and hard carbonates, running 40 to 50 per cent. in lead, and 6 to 15 ounces in silver to the ton. At the junction of the incline with the drift, a prospect drift has been driven to the northeast, which also discloses 2 to 3 feet of equally fine ore.

The second station opens into a level running south 100 feet, where a cross drift extends both to the east and west. At this juncture a good body of ore is disclosed on which no work has yet been done. Thirty feet west of the main level, extending in a southeasterly direction, is a drift 60 feet in length, showing fine veins of ore in several places along the sides and in the breast. This drift is laid with rails and an ore chute or mill connects it with the workings in ore on the upper level, affording economical and expedient means for bringing the ore from the upper incline to the shaft.

In a prospect drift running westward from the southeast drift above referred to, a winze has been sunk to a depth of 20 feet, and this also shows 2 feet of heavy carbonate ore. All told, the mine discloses 8 or 10 good looking ore faces, ranging in thickness from 2 to 4 feet, and opened up along the trend of the ore shoots from 5 to 50 feet.

Little Ellen Hill includes all that territory which lies between Big and South Evans gulches and the range. Among its more or less paying mines I would mention the Little Ellen, Trade Dollar, Opulent, Virginius, Kohinoor, Tenderfoot, Izzard, and Cleaveland. The best developed mines are the Little Ella, with the Trade Dollar, with a 900-foot tunnel cutting their lengths diagonally, now over 900 feet in, and the breast at least 800 feet beneath the surface, and not very far from the side line of the New Year. The ore in this central part of the hill is superior in quality and quantity to what has been mined nearer the surface. Not a little of the carbonates in this hill has been mined, but the great depth to the contact will be an impediment for some time to a great many claims.

The Little Ellen is the property of the American Mining and Smelting Company. At present the product of the mine is regulated by the requirements of the smelter, and the production does not prove so important a factor in the output of the camp as might be expected from the large ore bodies in sight. Development work is, however, fully maintained, the incline being down nearly 1,000 feet and an almost inexhaustible quantity of ore has been opened up and blocked out ready for stoping.

On the north side of the hill is the Opulent. Owing to litigation the property has been worked but very little.

The Cleaveland, between the Opulent and Tenderfoot, is being explored and developed by lessees, who occasionally strike small pockets of ore. The mineral contains silver and lead and small quantities of gold; it is low grade and very silicious, but the proximity of this property to the Tenderfoot is an assurance of striking ore, as the large body exposed in that mine must extend underneath the lines of the Cleaveland.

The Tenderfoot is in South Evans gulch. It is developed by a shaft 100 feet deep, from which a drift is run in a southeasterly direction for a distance of 300 feet, and for 250 feet is a solid body of ore, which is from 15 to 25 feet thick. Crosscuts and winzes are being run in different directions to prove the extent of this ore body. No stoping is being done, and no ore shipped, except that taken out in development. The ore is worth about $30 per ton above the cost of treatment.

The Izzard is being worked with good results. Near the outcrop the ore was of low grade, but improved in richness with depth.

On Sugar Loaf Mountain and Tennessee Park the mines, though not large producers, are coming to the front, and at no distant day this locality will be a good producer. Among the most prominent are the Birdie R., Dinero, Gunnison, and Sundown.

The Birdie R. is located on Sugar Loaf Mountain, and is one of the best mines in that promising section. This property is opened by a shaft 95 feet in depth, at the bottom of which drifts have been driven both ways on the vein, 30 feet in one direction and 50 feet in the other. Developments are being pushed to put the mine in shape.

The Gerrald Griffin mine is a new location. The developments now consist of a shaft 65 feet deep, from which 37 tons of ore have been shipped, taken out during the sinking of the shaft.

The Gunnison mine is the largest producer in this locality. The development consists of one working shaft 215 feet in depth, and three levels running therefrom at depths of 67, 161, and 211 feet, respectively. The first level runs north about 280 feet and south from main shaft 155 feet. The second level runs north from working shaft 200 feet and south 100 feet. The third level is just in under cover from main shaft. The first and second levels are connected by air-shafts 100 and 110 feet, respectively, on north and south side of main shaft. The ore is sulphuret, first class running 2,000 ounces silver, and one-fourth ounce gold. The second class runs about 400 ounces silver and about the same same in gold, and the third class from 50 to 70 ounces silver and one-tenth ounce gold per ton. This is a true fissure vein, with well defined granite walls, the vein matter being decomposed granite quartz and talc. During the last few months machinery has been placed, and when spring opens some twenty to thirty men will be employed.

The Dinero, in Sugar Loaf Gulch, has been employing on an average twenty-five men during the year. This is the oldest shipper in this locality. It is a true fissure vein, being 4 feet between walls, and a pay streak about 20 inches, but getting wider with depth. It is developed by a shaft about 200 feet deep and numerous levels and drifts. The south drift from the first level has just been started, and shows a good breast of ore. The north drift from this level is about 125 feet in length and the pay streak is 2 feet wide in the face. Two drifts have been run from the second level, the south drift being 80 feet long and showing a vein of sulphide ore 10 inches in thickness in the face. The north drift from this level has been run a distance of 125 feet, and a breast of ore 3 feet thick is exposed in the face. The third level is run from near the bottom of the shaft, and the north drift is also about 125 feet in length. The south drift from this level is about 50 feet long. Water has caused much trouble and annoyance, and Manager Langhorne has started a tunnel on the vein, which at present is 220 feet long, but eventually will be 700. This tunnel has disclosed some fine ore from which regular shipments are being made.

The Sundown is a promising looking property, but on account of water, has not been worked steadily. The shaft is 90 feet, at which depth a drift is run 80 feet, showing a vein of ore 6 inches, that mills about $800 per ton.

Long and Derry Hill seems to have grown into disfavor with mining men. Enormous sums have been spent in the development of the mines, as well as in prospecting, and but a small amount of ore been discovered, save in the Belcher Center, and Long and Derry Group. From the Long and Derry Group some pockets of rich ore were found, from which considerable was realized. But for the cramped manner in which the miners were forced to work, and the way expenses increased in carrying and dragging the ore out of the workings, handsome profits might have been made. The property shows a fair contact vein somewhat disturbed by a series of faults. The original development work was on a narrow belt of contact containing some ore, but directly between two faults or brakes. New developments have, however, been started east of the old workings, which, so far as they go, give good indications of mineral.

On Gold Ridge is the property of the Roseville Alta Consolidated Mining Company, seven claims, with an area of 65 acres. During the year but little has been done except perfecting titles and sinking a large working shaft 250 feet deep. So far as opened these show fissure veins of free-milling gold quartz from 1 foot to 40 feet between walls of granite. In addition to the claims on Gold Ridge, this company owns on Canterbury Hill five other claims. These, as far as opened, show contact veins, with blue lime for foot walls and porphyry hanging walls. The ore is a carbonate of lead carrying chlorides, with traces of gold. These five claims possess between 45 and 50 acres. The developments consist of about 1,200 feet of shafts, well timbered, and about 600 feet of drifts and tunnels, that show indications of bodies of good grade mineral.

The Herald gives the following statement of Leadville's production for 1883:

*Production of the Leadville smelters and mills during* 1883.

| Name of works. | Lead. | Silver. | Gold. | Value. |
|---|---|---|---|---|
| | *Tons.* | *Ounces.* | *Ounces.* | |
| Arkansas Valley Smelter | 8, 600 | 1, 284, 161 | 3, 370 | $2, 219, 577 |
| Harrison Reduction Works | 7, 521½ | 652, 563 | 4, 586½ | 1, 456, 252 |
| The La Plata Smelter | 4, 875½ | 1, 090, 898 | 1, 340 | 1, 632, 050 |
| The Manville (Elgin) Smelter | 1, 544⅛ | 214, 776 | 932½ | 373, 433 |
| The American Smelter | 6. 812½ | 793, 362 | 10, 403 | 1, 655, 815 |
| Fryer Hill (late Commings & Finn) Smelter | 7, 517 | 1, 022, 230 | 1, 700 | 1, 767, 798 |
| Leadville Gold and Silver Mill | .......... | 181, 468 | .......... | 200, 755 |
| Tabor Silver Mill | .......... | 50, 409 | .......... | 55, 920 |
| Shields Stamp Mill | .......... | 23, 771 | 87½ | 28, 000 |
| Oro and Twin Lakes Gold Mills | .......... | .......... | 1, 500 | 30, 000 |
| Total | 36, 870⅝ | 5, 313, 638 | 23, 919½ | 9, 439, 600 |

*Report of ore produced by Leadville mines and shipped to Denver, Pueblo, Cañon City and other points for treatment.*

| Mines, &c. | Lead contents. | Silver contents. | Gold contents. | Commercial value. |
|---|---|---|---|---|
| | *Tons.* | *Ounces.* | *Ounces.* | |
| Arkansas Valley Company | 5, 940 | 726, 000 | 1, 750 | $1, 344, 440 |
| Cañon City Smelter | 680 | 59, 724 | 538 | 130, 862 |
| Mike and Starr Mine | .......... | 2, 210 | 121 | 4, 840 |
| To Salt Lake City | 150 | 75, 000 | .......... | 86, 000 |
| Eddy, James & Co | 21, 944 | 2, 262, 400 | 10, 972 | 4, 613, 704 |
| Colonel Sellers, Chrysolite, and other mines | 900 | 151, 200 | .......... | 240, 846 |
| Total | 29, 614 | 3, 276, 534 | 13, 381 | 6. 420, 692 |

*Production for Lake County*, 1883.

| | |
|---|---|
| By smelters and mills | $9,439,600 |
| By ore shipments from Leadville | 6,420,692 |
| By placer mines | 25,000 |
| | 15,885,292 |
| Less receipts from other counties | 326,000 |
| Total net product of Lake County | 15,559,292 |

The Leadville News gives the production of Lake County for 1883 as follows:

| | |
|---|---|
| Silver reduced at Leadville | $5,845,001 |
| Gold from smelters | 480,000 |
| Smelters, gold and silver product | 6,325,001 |
| Gold from mills | 250,000 |
| Total | 6,575,001 |
| Value of lead smelted at Leadville | 2,949,600 |
| Value of ore shipped elsewhere | 6,783,140 |
| Total metal product | 16,307,741 |

Assuming that the ore shipped to the value ef $7,783,140 gave the same proportion of gold, silver, and lead extracted by the Leadville smelters, we would have the following result:

| | |
|---|---|
| Silver (60¼ per cent.) | $4,081,841 |
| Gold (15 per cent.) | 340,000 |
| Total gold and silver | 4,426,841 |
| Lead (35¾ per cent.) | 2,356,299 |
| Total value mineral | 6,783,140 |

Therefrom we have as the money metal result of the year's work in Lake County:

| | |
|---|---|
| Silver | $9,931,842 |
| Gold | 1,070,000 |
| Total silver and gold | 11,001,842 |
| Lead | 5,305,899 |
| Total product | 16,307,741 |

In this estimate no allowance was made for the value of the ore shipped from other counties for treatment by Leadville smelters. Adding to the 5,313,638 ounces of silver produced by the Leadville smelters and mills during 1883, the reported quantity of silver contained in the ore produced in Leadville mines and shipped to other points for treatment, 4,276,534 ounces, would give a total of 9,590,172 ounces. From this must be deducted the silver contained in ores shipped to Leadville smelters from other counties during 1883. The reports of the Union Pacific and Denver and Rio Grande Railroads, show the same to have been as follows:

| | Tons. |
|---|---|
| Chaffee | 194 |
| Eagle | 5,802 |
| Gunnison | 103 |
| Park | 151 |
| Summit | 6,327 |
| Total | 12,577 |

Assuming that this ore contained the same amount of silver as the published average of the ore shipped from Leadville, 26½ ounces per ton, the amount of silver contained would be 333,290 ounces, which, deducted from the amount produced and shipped, would leave 9,257,882 ounces, worth at its standard dollar coining value $11,969,787. Deducting for loss in treatment 3 per cent. on the 4,276,534 ounces of silver shipped, would make in round numbers the actual silver production of Leadville mines $11,800,000. In gold a similar deduction must be made for gold contained in ores from Park, Chaffee, and other counties.

After a very careful examination of all the information which I have been able to obtain on the subject, including the reported and published product of the smelters and reduction works, the reports of the mines, the estimates of Mr. Silver, and the leading papers of Denver and Leadville, the amounts shipped by the railroads and express companies and received at the mints of the United States, I have placed the production of the precious metals of this great mining section for 1883 at—gold, $400,000; silver, $11,700,000; total, $12,100,000.

## LA PLATA COUNTY.

I am indebted to Mr. Blair Burwell, of Needleton, for the following article descriptive of this county:

"La Plata is the southwestern county of Colorado. Approximately it is 50 by 100 miles, the latter from west to east. Its mining districts are California, Cascade, Florida, and Needle Mountain. California district embraces the La Plata Mountains, a lofty group near the center of the county. These mountains rise to nearly 14,000 feet, and are of dolerite, porphyry, and sandstone. Cascade district embraces the Cascade Mountains in the north center. This district is unknown to the writer, but he is informed that many of the veins are of the contact character, between porphyry and limestone. In a course from northwest to southeast, the San Juan Mountains, which is the continental divide, cuts the northeast corner of this county. Just here the range, more rugged than elsewhere, rising to great heights, is, on account of sharp peaks and craggy outline, called the Needles. Many peaks are either nearly or more than 14,000 feet above sea level. In their midst or around these, on the west, east, and south, are the three camps constituting the Needle mines. Named from their water-sheds we have Animas basin on the west, Vallecito on the east, and Florida on the south, the two first constituting the Needle Mountain mining district, and the latter the Florida. The country rock is granite, passing sometimes into quartzite and occasionally into syenite. Lower down, porphyry and trap rocks are met with. Starting from Durango for the Needles, one notices that all rocks are tilted—dipping from the range; and in the 35 miles from one to the other, sand and lime stones, schist and gneiss, are passed, aggregating 20,000, perhaps 30,000 feet. In the folding, forming the chain, this range was the axis and must then have been much higher. But time, frost, glaciers, and erosion have wrought changes; working it out that we now are at one and the same time higher, yet deeper, than elsewhere. To this fact we attribute finding mineral near the surface; and this in turn has been the cause, as against short seasons and rough trails, of what growth the camp has had. Until the past year work has been superficial. During its summer a wagon way was completed to Animas basin, which is within 1½ miles of Vallecito and 3 of Florida basins. With increased facilities, cheaper supplies, and more men, more has been done; and while no shipments of consequence have taken place, such quantities of ore have been placed on dumps, or stripped and put in sight, that some reality is being given to former conjectures. In a district where there are hundreds of locations, with work yet only fairly begun, it is difficult to go into detail, enough, perhaps, to outline.

"Nearly or quite seventy-five claims are in process of patenting. Messr. Webb, Anderson & Whiton, who are the largest owners, have forty-seven. During 1883, these men ran 2,000 feet of tunnels, cross-cuts, and shafts. By others considerable work has been done. In the Black Giant, Eureka, Allie Davis, May, Mayflower, Mustang, Clipper, Iowa, Phaeton, Chief, Dolly Varden, numbers 1 and 2, Sunnyside, Iron Valley, Jennie Hayes, Mountain King, Occident, Judson, June, Surprise, Storm Lake, Wall Street, Sylvan, and Ranger, bodies of mineral from fair to large have been reached. In several of these, notably the first twelve, both quantity and quality are good. The great bulk of the ore ranges from 30 to 50 ounces to the ton, but some bodies of size will average 100 and even 200 ounces, while in the Boer, Southern Cross, Little Jim, Truckee, Wilbur, and Mechanicsville, ore as yet in no quantity assays from 1,000 to 5,000 ounces. Silver predominates, but in many claims gold is found. Gray copper is the characteristic ore. Some few claims have bodies of galena, but generally the galena, zinc blende, copper, and iron pyrites of the surface, passes into gray copper, petzite, bismuth, silver, or silver glance, generally the first. The veins are quartz, accompanied by talc, fluor, and calc-spar. The distance to which they can be traced, the width, and evenness of width, and number of consecutive locations carrying mineral, is unusual. Except on the Black Giant and Lincoln heretofore, work has been done only during the months of June, July, August, and September. Cabins have been built, supplies laid in, and work for the winter is now being pushed on the Black Giant, Sunnyside, X-10-u-8, Little Jim, Wilbur, Lincoln, Nonpareil, Mechanicsville, Pattie, and others."

Eighteen hundred and eighty-three has been a year of rapid strides and favorable impressions.

Mr. J. P. Wallace, of Animas City, La Plata County, has furnished the following information in relation to the mines of the *California district* of this county:

"This district includes all the mining camps of La Plata Mountains proper. The mineral belt extends from east to west about 8 miles, and from north to south nearly double that distance. The district is divided by nature into four grand sections, each of which receives its name from the stream traversing it. Junction Creek heading on the eastern slope pursues a general southeast course, and empties into the Animas River at Animas City. La Plata River arises quite near and a little to the west of the source of Junction Creek, and through 12 miles of its southerly course cuts a deep canyon through the very heart of the La Platas. Bear Creek has for its source a point on the northern slope about 1 mile to the east of Hesperus Peak. Running a general northwest course, this creek empties into the east fork of the Dolores River.

The Maucos River drains the west side of the La Plata Range, and is formed by its three tributaries, the West, Middle, and East Maucos.

The formation of the district, in general terms, is porphyritic trachyte and quartzite. Slates and limestones outcrop in many places, more especially in the west half of the district. Metamorphic granite, according to Hayden, underlies the whole La Plata Range.

Aside from the varied character of the mineral constituents of individual lodes there are two classes of ores which stand out most prominently, and, from their frequent occurrence, give to the district its distinguishing mineral characteristics. These are gold-bearing iron pyrites and telluride ores. Commencing at Bear Creek on the north, and extending in a general southerly course along a high range to within a few miles of Parrott City, is a mineral tract which is pre-eminently gold-bearing. Pyrite is the chief base.

Many of the lodes are unusually prominent and of great width. But few of the larger veins have been cut across their entire width. Where development has been pushed to any considerable extent a magnificent property has been shown. Extending from Junction Creek westward across the divide to the several tributaries of La Plata River is a belt which is notably telluride in character. Prospectively considered some of these veins are of great value.

Development during the past season has far exceeded that of any previous year. The district, as a whole, is surely but slowly paving its way for large outputs of ore in the near future. The chief drawback to enlarged production is the almost total absence of wagon roads. This is the great and crying need of the district. Akin to it, and but little removed in importance, is the lack of suitable concentrating machinery. With these two requisites it is confidently believed that the La Platas would soon rank in importance with the leading mining camps of the State. The books of the county recorder show over seven hundred mining locations in this district. It is safe to say that at least one-third of this number are now being worked.

*Junction Creek.*—The Kennebec is owned by the Kennebec Mining Company, of LaFayette, Ind. The vein has an east and west trend, with a dip to the north. A shaft has been sunk to the depth of 90 feet, through a continuous pay streak averaging 10 inches. From the bottom of this shaft a drift extends eastward 130 feet, where it connects with a cross-cut tunnel leading to the gulch. At this connection the pay streak is fully 3 feet wide, and consists of beautiful white quartz impregnated with ruby silver and a sulphide of the same mineral. The mine has produced some wonderfully rich ore. The average unassorted ore will mill $100 per ton. About $15,000 has been expended on development and improvements. No shipments have been made. All ore is held in reserve. Application has been made for a patent. From some unknown cause the property has not been worked during the past year. It is in good paying condition.

The Lucina is a well-defined vein of white quartz, with a mineral streak of exceedingly rich ruby siver and tellurium, averaging 4 inches in width. The unassorted ore averages $119 per ton. A shaft of 35 feet constitutes the development.

The Gold Wedge has a mineral streak of 11 inches of telluride ore. Mill returns show a value of $75 to $190 per ton in car-load lots. The average in gold is 80 per cent. and in silver 20 per cent. Specimen assays are marvelously high. By means of two drifts, one measuring 60 feet and the other 70 feet, the vein is cut at a depth of 130 feet below the surface. It is remarkably well located for extensive working at the least possible cost. The output the coming season will undoubtedly be large.

The Saint John is on the same vein as the above, and bears essentially the same characteristics. Both claims have been patented.

The Iridos is located on the southeastern slope of Chicago Gulch. The claim is heavily timbered with spruce. The trend is 15° by 8″ south of west. It is a large vein, the exact width of which is unknown. The foot wall alone has been exposed; this is in porphyry. A shaft of 70 feet has followed continuously a mineral streak varying in width from 4 to 8 inches. This shaft is intended to connect with a drift lower down which is now driven to a distance of 32 feet. The ore is gold amalgam and native mercury. The latter occurs in considerable quantity, and, owing to its rarity, excites curiosity on the part of all observers. The value of the ore ranges from $100 to $300 per ton, mostly gold. About 20 tons of ore now remains on the dump. This property will probably see a bright future.

The Ruby King, on Flegler's Fork, is a well-defined vein between walls 4 feet 6 inches apart. Its course is east and west. The lode is opened by a tunnel on the vein from the east to a distance of 75 feet, and a like opening on the west of 150 feet. A shaft of 105 feet has been sunk through pay mineral the entire distance. The vein has two mineral streaks, one from 8 to 12 inches wide, and carrying an average ore value of $150 per ton; the other from 12 to 16 inches wide, with an average ore value of $54 per ton. No stoping has been done. There is now about 100 tons of ore on the dump.

The J. L. Russell crops out with great prominence. Its width is undetermined. So far as development has progressed there is shown a 3-inch mineral streak of very high grade tellurium ore, in which free gold specimens are not unfrequently seen. The lode traverses the eastern slope of the mountain, and affords most excellent facilities for development.

The Jim Smith is the westward extension of the last named, and carries the same character and quality of mineral.

The Snow-Storm Mining and Milling Company, of Indianapolis, Ind., own and are now working some of the finest properties in the district. They comprise the Snow-Storm, Cumberland, North Star, and Lady Douglass. All are located on or near the dividing ridge between Junction Creek and the La Plata River, and are about 16 miles from Durango. The properties were leased in August, 1883, to John Hallahan & Co. At this time but little more than assessment work had been done on any of the claims. Under the efficient management of the lessees, a great change has been effected. The Cumberland has been opened the west end by three levels. The first and second levels each measure 220 feet. The third and lowest level now measures 70 feet, but when further extended will intersect a cross-cut tunnel being driven from the east end of claim, which will cut the vein at a depth of over 400 feet below the surface. The cross-cut now measures 200 feet, and requires but 150 feet more to reach the point of intersection on the vein. When this connection is accomplished the ore will all be taken from the east side of the mountain nearest to the mill. The cost of transportation over 2 miles of rough trail will thus be saved. About 125 tons of ore have, at this writing, been taken out, which it is thought will average $125 per ton. Some of the ore has averaged as high as $200 per ton. The vein is a very large one, and has been sufficiently developed to justify the hopes of a true fissure. The character of the ore is principally brittle silver, with some gold. The average pay-streak is 18 inches. It is confidently expected by the lessees that not less than 25 to 30 tons of ore per day will be mined during the next season. The company have erected a five-stamp mill with a roaster on Junction Creek. The mill will be run by water-power or steam, at pleasure. This mill is now completed and has just made a very successful trial run. It will be pushed to its full capacity next spring. The remaining three claims mentioned above all show a good grade of mineral and offer a promising reward.

The Summit lode, situated on the divide between Lightner and Junction Creek, is 4 feet wide, with a mineral streak of 2 feet. The gangue is snow-white quartz in porphyritic trachyte, and carries galena and iron and copper pyrites. The assays run from 12 to 150 ounces silver, and from $2 to $10 in gold. The workings consist of four annual assessments in form of an adit 20 feet deep.

The Hidden Treasure, on the center fork of Lightner Creek, is 5 feet wide, with 4 feet of mineral-bearing rock. The gangue rock is snow-white quartz, occurring in a dike of porphyritic trachyte. The mineral is galena, zinc, pyrites of iron, and sulphide of silver, which assays from 20 to 300 ounces in silver and from $2 to $12 in gold. The workings consist of a shaft 25 feet deep and an adit of 12 feet.

The Puzzle, also on Lightner Creek, is very similar in size and character to the preceding. It is opened by a shaft 20 feet deep and by an open cut of 12 feet.

The San Juan, located in Hall's Gulch, is 4 feet wide, with a pay-streak of 2 feet. The mineral is iron and copper pyrites, and has an assay value of $30 in gold and 50 ounces in silver. There are two open cuts on vein of 15 feet each.

*Bear Creek.*—Among the most prominent lodes in this camp is a group of eleven claims, all discovered and owned by one party. Located as they are, conveniently close to a central point, with a superabundance of timber and water-power on the claims, the best possible facilities for economic development are afforded. All the claims possess, in a large degree, the same mineral characteristics, differing principally in point of richness and size of ore body. Gold-bearing iron pyrites is the prevailing ore in each. The formation is quartzite, overlaid in many places with porphyritic trachyte. The quartzite graduates below into metamorphic granite. Following is a brief description of this group:

The Century is located at the edge of timber-line, on the west side of Bear Creek Basin. The slope of the mountain will average 45°, but is interrupted by three benches or tables. Most excellent opportunities are thus offered for drifting and shafting. All possible chances of snow-slides are also avoided. The vein has an east and west trend and a dip of 5° to the south. The width between walls is 4½ feet, and the average width of pay-streak is 13 inches. The lode is opened by three drifts, measuring, respectively, 78, 86, and 78 feet, and by one shaft of 45 feet. The shaft now intersects the first level and will soon be united with the second and third levels. When these connections are made all the ore will be taken out from the lower level. The out-put of ore thus far is 121 tons, of which there has been shipped to Pueblo and Denver 46⅕ tons. The remaining quantity, nearly 75 tons, yet remains on the dump. The returns in cash for the 46⅕ tons were $12,928.61, or an average of $279.84 per ton. The yield is almost exclusively in gold. An accurate estimate of the ore now in sight in the mine and based upon the above shipments, shows a valuation of $100,710.64. The ore is iron pyrites set in a quartz matrix. It is pronounced by experts to be free-milling.

The Hoosier is the eastern extension of the Century, and carries mineral of the same character. But little development has been done in this claim. It prospects well, however, and bids fair to make a fine property.

The Cæsar is a parallel claim to the Century, and lays about 500 feet to the south of the latter. It is a strong and well-defined vein, 5 feet between walls, with a pay-streak of 20 inches. The lode dips 15° to the south. Its mineral is iron pyrites, galena, and zinc blende. The average ore samples $140.47 per ton, of which two-thirds is gold and one-third silver. The vein is opened by two drifts, each of which measures

40 feet. It is admirably located for extensive and economic working The ore is smelting in character and easily concentrated.

The La Fayette, located on the west of the Century, has a northeast and southwest trend. The vein is fully 30 feet wide, and stands out in bold relief from the precipitous cliff which it crosses. The pay-streak on the hanging wall measures 3 feet, and samples from $30 to $100 per ton. The exploitation has not extended to the opposite wall. The one is gold-bearing iron pyrites. A drift of 35 feet has been driven along the hanging wall.

The Cincinnatus, pursuing a northeast and southwest course, crops with great prominence for three-fourths its length. It is 5 feet wide, with a pay-streak of 18 inches. The mineral is iron pyrites. Numerous assays show an average yield in gold of $43 per ton. The lode is opened by a drift of 15 feet.

The Romulus is fully 10 feet wide. It presents a bold and rugged appearance in many of its outcrops. A tunnel has been started at the foot of the bench which the lode crosses. The mineral is iron pyrites, associated with a soft yellow mass of clayey texture. No assays have been made.

The Wabash is a large and prominent vein coursing northeasterly and southwesterly. Pyrites and talc occur in large quantities in the quartz-gangue rock. It is difficult to determine just how much of the vein matter is pay-ore, as the whole face of the drift is more or less impregnated with mineral. No mill-runs have been made. Sample assays indicate an average of $40 per ton in gold. A drift has been extended 20 feet.

The Great Falls is the eastern extension of the former, and carries the same character of mineral. It crosses a cliff about 90 feet high, and affords excellent working facilities. A drift has been started from the bottom of this cliff which opens the vein at great depth.

The Quiz is well-defined, with prominent croppings throughout its entire length. The walls are of true porphyry, and the gangue a beautiful white quartz. The mineral is ruby silver and sulphide of silver associated with iron pyrites. The assays range from $100 to $300 per ton. The pay-streak is from 6 to 13 inches wide. A shaft and two drifts have been started, each averaging about 10 feet. Direction of vein east and west.

The Jefferson is an extension of the last named. The walls are perfectly straight and smooth, and are 4 feet apart. The whole gangue rock is mineralized, principally with gold-bearing iron pyrites, which will average $25 per ton. Development consists of one drift 20 feet in length.

The Sherbrooke is a large vein with but little development. It carries some very rich mineral, and will doubtless prove good property. This is the last of the eleven claims composing the group spoken of above.

The Bell Hamilton and Cyclone Consolidated Mining Company own the Bell Hamilton and Cyclone lodes. They are located 4 miles from the head of Bear Creek and on the east side of said stream. The first mentioned is a perpendicular vein of east and west trend, measuring 6 feet between walls, with a pay-streak varying in width from one-half an inch to 5 inches. The ore from this streak is native silver and assays as high as $10,000 per ton. A drift and a shaft, each measuring 20 feet, comprises the development. The Cyclone is a blanket ledge and cuts the Bell Hamilton at right angles. The ledge is 10 feet wide. The principal mineral is copper glance, which assays 50 per cent. of copper, 10 ounces silver, and $10 gold. A tunnel has been driven 260 feet. No shipments have been made.

The Little Pearl is a very prominent vein, cutting a precipitous cliff of quartzite. It is 4 feet wide, has excellent walls, and bears evidence of a true fissure. The mineral streak is 18 inches wide, and carries gold-bearing iron pyrites, from which assays have been had of $110 per ton. A drift of 25 feet and a shaft of 8 feet constitutes the development.

The Princess Laura is an extension of the Little Pearl, and carries a similar quality and character of mineral.

The Highland Chief is 10 feet wide, with a mineral streak of 14 inches, It carries principally galena, with considerable copper and iron pyrites. It assays $28 in gold and $10 in silver. A drift has been driven on the vein 56 feet.

The Pride of Bear Creek, a promising vein near the last named, carries 12 inches of pay-rock, which assays $20 in gold. A shaft has been sunk to the depth of 10 feet.

The Ben Skinner carries iron pyrites in a matrix of quartz and spar. The mineral assays $119 per ton, mostly gold. It is a good prospect.

*La Plata River.*—The Cora G. is located in La Plata Basin. The trend of lode is east and west. It has a well-defined outcrop of beautiful white quartz impregnated with ruby silver and silver glance. The pay-streak is fully 12 inches wide. The ore-mill runs $238 per ton. A shaft of 20 feet and a cross-cut tunnel of 75 feet will include the development at present writing. Work is being prosecuted with vigor.

The Laura A., a blind lode, is the eastern extension of the preceding. It was discovered and located July, 1883, in a cross-cut tunnel driven by The Washington and La Plata Mining Company. This company was organized for the especial purpose of prospecting for this lode; they have been richly rewarded. The lode was in the tunnel at a distance of 275 feet. A drift from this point eastward has now reached 95 feet. The pay-ore varies in width from 4 to 12 inches, and assays $880 per ton. Mill-runs from selected ore have shown returns as high as $200 and $450 per ton. The character of the mineral is similar to the preceding lode.

The Shoo Fly is one of the most flattering prospects in this camp. Although located in 1882, the lode was not known to possess marked value until the succeeding year. It is a mammoth vein, with east and west trend, and measuring from 36 to 40 feet in width on the surface. The walls are quartzite and porphyry. A tunnel 70 feet in length has been driven along the north wall on the outside of the vein, and at right angles to this a cross-cut is being extended to the opposite wall. In this cross-cut a mineral streak has just been encountered which is 23 inches in width, and which assays $2,708.85 per ton in silver. The ore is an antimonial sulphuret. The surface outcrop shows a mineral streak on the south wall 4 feet in width, from which samples of 50-pound lots have yielded a value of from $30 to $87 per ton.

The Crown is the eastern extension of the above, and compares favorably with it. The croppings assay $653 per ton. There are nine other locations on the Shoo-Fly vein which are said to be plainly traceable.

The Ashland, on Lewis Mountain, is 4 feet wide, with a pay-streak of 12 inches. Its ore is a telluride with some native mercury. A shipment of one car-load of ore yielded an average value per ton of $136. The vein cuts through porphyritic trachyte. A shaft has been sunk to the depth of 35 feet. Patent applied for.

The Tenbroeck and Sylvan No. 1 and No. 2 are on the same vein as the preceding, and have the same general characteristics. The Sylvan No 2 has applied for a patent.

The Eureka, at head of Lewis Creek, is 5 feet wide, and is all pay-ore. It will average throughout about $60 per ton. A streak of 12 inches on one wall assays $300 per ton. A shaft of 50 feet and a drift from bottom of shaft measuring 40 feet constitutes the development. A force of six men will work this claim all winter. Patent applied for.

Lorillard No. 1 is a large and prominent vein, measuring 10 feet in width, with 3 feet of pay-ore, which will average 40 to 50 ounces silver per ton. The mineral is principally brittle silver. The vein has a drift of 25 feet. Patent applied for.

Parolle No. 2 measures 5 feet between walls, has a pay-streak of 2 feet, and averages 45 ounces silver per ton. Patent applied for.

Little Mack is a fine-looking vein 2 feet wide, all pay-ore, averaging $100 per ton. The ore is brittle silver. There is a tunnel of 30 feet on vein. Patent applied for.

The South Comstock, located 3 miles north of Parrott City, is a most promising property. It is opened by a shaft 150 feet deep and by a drift of equal length. The vein is fully 15 feet wide, and lies between quartzite and porphyry. The gangue rock contains several pay-streaks, one of which is composed of very high grade petzite. Another mineral streak carries sulphide of silver. Some beautiful free-gold specimens have been taken from this lode. The average of all the ore between walls, it is thought, will mill-run $40 per ton. The value of ore-shipments thus far made will probably not fall short of $10,000. The lode is patented.

The North Comstock is an extension of the preceding. Although less work has been done on this lode it bears evidence of rivaling in richness and output the south lode. The same mineral characteristics are present.

The Morovoratz is 3 feet wide; has pay-ore from 12 to 14 inches in width, which averages $280 per ton. The mineral is chloride of silver and black sulphurets. About $1,000 has been expended on development.

The Manhattan is an immense vein with a mineral streak of 28 inches. Mill-runs have a valuation of $200 per ton of assorted ore.

The Little Ida is inclosed between syenite and porphyry walls, and measures 8 feet wide. It carries 2 feet of copper and iron pyrites, which will average $60 per ton. It crops boldly above the surface for a long distance.

The Copper Age is located in Bed-Rock Gulch, just below timber line, and intersects quartzite. The lode is 8 feet wide, and carries red oxide and native copper, with considerable gold. The copper will probably average 25 per cent. Development consists of 150 feet.

The Heck, located in Tiburcio Gulch, is of great size, and lies between lime and porphyry. The pay-ore lies in a space of 3 feet. The mineral is telluride. Shipments in several ton lots gave for first-class ore a valuation per ton of $537, and for second class $135 per ton. About 35 tons are now on the dump.

The Bulldozer, located on south slope of Lewis Mountain, is 5 feet wide, with 4 feet of mineralized quartz. The mineral is pyrites of iron and copper, with some native gold and silver. It assays from $50 to $500 in gold and silver. The workings consist of two open cuts 25 and 20 feet respectively.

The Good Hope, on southern slope of Lewis Mountain, is 7 feet wide, with a mineral streak of 6 feet. The mineral is pyrites of iron with sulphide of silver, and assays from $10 to $200 in silver. It has a shaft of 25 feet.

The Rahway, on Silver Mountain, is 10 feet wide, with a mineral streak of 8 feet. The mineral is galena, iron pyrites, and yellow carbonates, and assays from 20 to 30 ounces silver and $17 gold per ton.

The St. Elmo, located in Burnt Timber Gulch, 1½ miles east of La Plata River and 2½ miles from Parrott City, is 4 feet wide, with a mineral streak of 3 feet. Gangue rock is porphyry and lime. The mineral is iron pyrites and copper, which assays from $20 to $1,000 in gold and silver. Working consists of an adit of 20 feet.

The Excelsior, located on the southern slope of Lewis Mountain, is 7 feet wide, with a pay-streak of 6 feet. The gangue is porphyry, lime, and mica schist. The mineral is galena, gray copper, and iron pyrites, and assays from $12 to $250 per ton in gold and silver. There is a shaft of 25 feet on vein."

The production of La Plata County in 1883 was, approximately, gold, $13,000; silver, $5,000; total, $18,000, a slight reduction from 1882.

### OURAY COUNTY.

I am indebted to Mr. F. C. Meyer for a report on the mines of this county, much of which I have incorporated into the material prepared by Mr. Silver. By an act of the last legislature of Colorado this county was divided into Ouray and San Miguel Counties, and as the latter received over one-half of the mining section formerly comprised in Ouray County, this fact must be taken into consideration in comparing the output of mineral of 1883 with that of the previous year. The area of this county comprises all that territory drained by the headwaters of the Uncompahgre River. It is about 40 miles in length and about 20 wide. The altitude of the southern boundary is from 12,000 to 14,000 feet, the land gradually falling away until on the northern boundary the altitude is about 6,000 feet. The southeastern portion of the county is composed of rugged mountains, whose peaks reach far above timber line, and whose forbidding heights would rarely be disturbed by the footsteps of civilization, were it not for the rich views of gold, silver, copper, and lead running through.

Ouray County is divided into three mining districts, *Uncompahgre*, *Sneffles*, and *Red Mountain*. Probably no county in Colorado has, during 1883, received more attention from Eastern capital and emigration and had better prosperity than this, and consequently its advancement in producing mines has been rapid and steady. In every gulch and on almost every mountain one can find productive mines, many of which have never made shipments because of the want of economical modes of reduction, and because of the high charges for transportation.

The "Mear's system," by which roads were built during the past summer, has greatly facilitated the transportation of the ore. In the districts of Uncompahgre and Sneffles Eastern and European capital has done much towards developing the prospect holes into producing mines. In the Red Mountains prospects at once become mines, shipping almost, from grass roots. The prospector himself, without the aid of capital, has been able to do the development work in this district. Though the average of the ore is but medium grade, its immense quantity and the inexpensive mode of extraction leave a good profit to the miner.

The Yankee Girl and National Belle are two wonderful mines.

The Yankee Girl has shipped during the year about 5,000 tons of ore, the lowest average netting about $125, while some shipments have run from $2,000 to $4,000 per ton. The record of the National Belle is but little short of this.

The other mines that have shipped ore are the Hudson, Maud S., Treasure Trove, Grand Exchange, Guston, Robinson, Orphan Boy, Grand Prize, Gennese, Champion, Salem, Carbonate King, Jed, Little Annie, Gaudalupe, Charter Oak, Tin Cup, Mountain Lion, Blackstone, Galena Queen, Galena, Galena Lion, Silver Ledge, Turkois, Sailor Boy, Mineral King, Sunshine, Atlantic, Independence, and Little Maud. There are others besides, whose shipments have been too small to entitle them to be mentioned, in the same district; but in San Juan County are many producing mines which show genuine lead carbonates, while others have large bodies of galena and black oxide of copper and gray copper, all carrying more or less silver.

The country rock is trachyte and granite. The mineral is found mostly in deposits. The average of the ore found in the Red Mountains is from $35 to $75 per ton. In Uncompahgre and Sneffles districts the ore is of higher grade, found in fissure veins, but not in quantities equal to the Red Mountain deposits.

Sneffles mining district continues to show well, several mines having been worked systematically with the most flattering results. This district includes many veins that will probably yield for years to come vast quantities of the precious metal.

The Agnes and Declaration were recently sold to an English corporation, to be known as the Agnes Mining Company Limited, of Liverpool.

The Declaration is an extension of the Yellow Rose, in which a big strike was made a short time ago; and the Agnes Company will begin operations immediately by running a drift on the vein. A shaft 230 feet discloses a 3-foot streak of ore that will average $50 per ton net.

On the Allied mines very little has been done in 1883. The property, consisting of the Crusader, Hidden Treasure, Norma, and Yellow Rose, is owned by an English company, and stocked for $10,000,000. Upon the Yellow Rose there is 680 feet of development, and the levels show pockets of brittle and wire silver. About 400 tons of ore on the dump will be concentrated when the roads are open for shipping, as will also the ore on the dump of the Hidden Treasure, probably 500 tons. On the Hidden Treasure there are about 300 feet in levels and drifts. Of the formation of these veins, and of other veins in Imogene Basin, William Weston, who is very well posted, says:

"The ores have white crystalline quartz as the matrix of the metals, and with galena as their base, including highly argentiferous gray copper or silver fahlerz, polybasite, silver glance, native silver in leaf and wire, red and resin blende, iron pyrites, copper pyrites, peacock copper, and the blue and green carbonates of copper. Calc spar occurs occasionally, both in the form of 'dog-tooth' and 'nail-head,' and in the Yellow Rose vein, large quantities of the silicate of manganese, and also the pink spar of carbonate of manganese, the latter being almost always accompanied by native silver and silver glance. These ores are usually of a 'combed' or 'banded' texture, the layers being parallel to the fissure. The quartz and ore is generally on the hanging wall, with a clay gouge or selvage between the former and the wall. From the ore to the foot-wall is soft gray porphyry, the walls being, as before stated, trachyte. This description, of course, only applies to the veins when 'in shape,' as, like all lodes, they are subject to 'caps,' 'pinches' and other changes."

Between Imogene Basin and Sneffles Basin is a spur known as Ruby Mount, and on this is situated the celebrated Wheel of Fortune group of lodes, of which there are six owned by the Wheel of Fortune Consolidated Mining Company.

The Wheel of Fortune is a cross lode to those of this belt, having a north and south course, and carries ore of a different character to the rest. It is in trachyte formation, and is about 7 feet between the walls, has soft porphyry for vein matter, and very light, white quartz as the gangue of the ore, the character of the latter being brittle silver, occasional ruby silver and gray copper, with the blue and green carbonates of copper. The average value of the ore is 135 ounces silver, and 1 ounce gold per ton. The Wheel of Fortune claim is the best developed, having four levels run on the vein. Level A is more of a cross-cut, being 260 feet in length, of which 175 feet is in ore, showing for that length a continuous streak, and from which 83 fathoms have been stoped. Level No. 1, 80 feet above level A, is 620 feet long; in this level the ore chute was stoped out in 1882. Sixty feet above level No. 1 is level No. 2, 175 feet long, and here also the ore is stoped. Level No. 3 is 75 feet above, it is 75 feet long and from it no stoping has been done, the ore remaining until the level can be pushed farther. These levels are connected by a winze, giving good ventilation to the mine.

The Grosvenor, north of the Wheel of Fortune Group, has a vein 3½ feet wide, with pay streak 18 inches; the ore is galena, gray copper, and sulphurets. Developments consist of a cross-cut, 15 feet from which is a drift 20 feet.

The Stonewall Jackson, near the Grosvenor, is a promising claim, 5 feet between walls, with a pay streak about 14 inches. The developments consist of two shafts, one 28 feet deep, the other 15 feet. In digging these shafts over $1,000 worth of ore was extracted and shipped.

The Mount Sneffles Mining and Smelting Company owns the Potosi, Seven Thirty, Circassian, Highland Lassie, and Buckeye Girl—five promising claims, but this property has not been worked beyond the necessary assessment since 1880. The level on the Potosi is 280 feet, showing ore of the same character as in the Wheel of Fortune, except that it has associated with it pink manganese spar and also arsenical iron pyrites with a bright yellow powder—the result of decomposition.

The Big Chief has a shaft 35 feet deep; a cross-cut is being run 250 feet to cut the vein 215 feet from the surface. The vein is wide and the pay streak, which is about 14 inches, will average $175 per ton.

The Highland Chief has a drift on the vein 55 feet, and a cross-cut 63 feet that cuts the vein; from this cut a drift was started which is now 18 feet long. Throughout these workings is disclosed a 4-foot vein, with pay streak from 20 to 28 inches of galena and gray copper, that averages $150 per ton net. Development will be pushed throughout the winter and next season the mine will be worked to its fullest extent.

The El Dorado is situated close to the Sneffles toll road at an altitude of 10,500 feet above sea-level. It crops out along the mountain side and has sites on it for at least five levels or drifts on the course of the vein. Three levels have been run, the lower one is 140 feet; the second 50 feet; and the upper 25 feet. In doing this work about 100 tons of ore were taken out, carrying from 50 to 100 ounces silver per ton. The character of the ore is ruby and brittle silver, gray copper, and copper pyrites with a small percentage of steel galena, the gangue being white quartz and some baryta.

On the other side of the basin from the El Dorado is the Yankee Boy group of mines, comprising the Yankee Boy, Dutch Boy, York State, and

Genesee. The Yankee Boy and Dutch Boy are adjoining claims on the same vein, as also the York State and Genesee on a parallel vein with the Yankee Boy, being about 130 feet distant. Two drifts have been run on the veins, each 250 feet in length. No ore has been stoped and none will be until the property is more thoroughly developed.

At the head of another fork of Sneffles Creek, but in the same main basin, is the property of the Caroline Mining Company, the Virginius mine—one of those notable lodes which, in miners' parlance, has "paid from grass roots." The ore is a galena and gray copper of a very high grade. The average width of the vein is about 4 feet, and the pay streak varies in width from 3 to 20 inches. The ore extracted this year has averaged about 35 per cent. lead and 200 ounces silver per ton. The mine is developed by a cross-cut tunnel 400 feet long, and from the point where the tunnel cuts the vein a drift is run, from which shafts have been sunk and winzes raised. There are five levels on the vein, which are about 100 feet apart vertically. The total aggregate in shafts and winzes is 650 feet and in levels 2,500 feet. The output of the Virginius during the year has been estimated at $70,000. The ore from which this was produced ran from 141 to 719 ounces of silver and 36 per cent of lead to the ton.

The Terrible mine is located near the Virginius. But for litigation it would probably have been one of the largest producers in this locality. The mine is developed by three levels, the aggregate length being 900 feet. The ore is similar in grade and character to the Virginius.

The Sidney is an extension of the Terrible mine, and is owned by the Emma Mountain Mining Company. The work consists of a cross-cut tunnel 546 feet long, which intersects the vein at a depth of 250 feet below the surface, encountering a body of very fine argentiferous galena, varying in width from 1 to 2 feet. Drifts were run both ways from the end of the tunnel, which at present aggregate 475 feet. The ore is galena and gray copper in a quartz gangue. Native and ruby silver have also been found in this ore, the native being in wires and apparently plastered onto the galena where it joins the quartz. The ore yields from 50 to 150 ounces silver and 35 to 50 per cent. lead per ton. This mine worked a small force, and its output was about $10,000.

Uncompahgre district includes the mines in the vicinity of Ouray. About 3 miles from that town is the Dexter. The vein matter is porphyry, and the ore galena, antimonial galena, and blende. No shipping has been done during the year, but development work has been steady. One drift on the vein is 800 feet, besides which there are two levels of 300 and 500 feet, respectively. On the dump are 400 tons of ore, valued at $12,000, which will be sorted and shipped as soon as the railroad reaches that point. Within half a mile of the town of Ouray is the Grand View mine; it is about one-half mile below and north of the town of Ouray, on the west side of the Uncompahgre River and on the east side of Ouray Mountain. The elevation is about 800 feet above the level of the river. The mine was located in the year 1875. In the fall of 1877 the locators sold to Col. E. F. Burton, of San Francisco, Cal. Burton also purchased a mill site, consisting of twenty acres of ground, lying immediately below and connecting with the surface ground of the Grand View, and having a river frontage of about 70 rods, makes one of the best water-powers on the Uncompahgre River. The development on the Grand View is as follows: The upper tunnel is 6 by 9 feet, and is in on the vein 210 feet. The second tunnel worked is 84 feet below the first and is in 110 feet. The principal part of the ore so far mined has been taken out of the upper tunnel. The average width of the vein between walls is 6 feet, and the average thickness of the ore streak is from

18 to 20 inches. Over 150 tons of ore have been treated, running from $71 to $226 in gold and from 13 to 40 ounces in silver per ton, and is at present on the bank of the river. Ore was treated at Argo, Pueblo, and Lake City. The character of the ore is iron and copper pyrites, blue and green carbonates of copper in a quartz porphyry gangue. The claim runs from the river up the almost perpendicular side of the mountain, and can be worked to a depth of 1,800 feet below the surface by driving levels on the vein.

The Denver and Rio Grande Railway survey runs across the Grand View dump, and when the Denver and Rio Grande is completed to Ouray, the ore can be taken from the miner's pick and delivered on the railroad track at a cost of less than 25 cents per ton. The Grand View was patented in 1879. This lode is developed by two tunnels; the upper tunnel is 200 feet in length on the vein, but the lower level has run off the vein. This vein is a true fissure, being 5 feet between walls, with ore streak of 20 inches.

In Bear Creek is the Union. This vein is 5 feet between walls and trends northwest and southeast. The pay streak varies in width from 10 to 30 inches. The walls are trachyte; the character of ore is ruby and native silver, with iron pyrites. The developments consist of 2,000 feet in drifts and winzes. There are three drifts, 450, 560, and 800 feet, respectively, and connecting winzes aggregating 190 feet. Very little stoping has been done during the year, the company waiting for cheaper transportation. The dump is covered with about 500 tons of ore that will average $40 per ton.

The Silver Link Mining Company owns the Silver Link Group of mines, comprising seven full locations, viz. Silver Link, Climax, Great Epoch, Ivanhoe, Rob Roy, Bryn Mawr, and Cader Idris. The three first named are consecutive claims on the same vein, and on these the company are working two shafts, running a cross-cut tunnel that at present is 1,000 feet in length, having 300 more to run before cutting the vein in the Silver Link claim. This tunnel will cut the vein 2,000 feet below the surface; the size of tunnel is 9 by 7. The width of the vein is 25 feet, with a pay streak from 8 inches to 3 feet, composed mostly of gray copper, that runs from 70 to 160 ounces silver and 27 per cent. copper per ton.

Adjoining the Silver Link Group is the Crystal Group. This group consists of the Crystal, Friend, and Challenge, adjoining claims on the same vein; the Confidence, an adjoining parallel vein; and the Grand Junction, a cross lode on the series. The veins are well-defined true fissures, about 10 feet between walls, and the ore mill runs from 50 to 443 ounces of silver per ton and one-half ounce of gold. The character of the ore is copper and iron pyrites and brittle silver, in a gangue of bluish quartz, and contains no zinc or galena. Nothing beyond assessment work has been done during the year.

The Belle of Ouray Silver Mining Company owns the Belle of Ouray, Way-up, Speculator, Morton, and one-half of the Champion lodes, all situated on Bear Creek. The property is developed by a tunnel 732 feet long, 443 feet of which is on the vein of the Morton lode; the balance is a cross-cut that cuts the Belle of Ouray vein, showing a width of 13½ feet. At this point levels were run on the vein north and south. A shaft has been sunk 145 feet from the surface, leaving a distance of about 35 feet to be sunk, when the shaft and tunnel will be connected. The ore shown in the upper workings was mainly a pure galena in a quartz vein, which carries from 27 to 150 ounces of silver per ton. The shaft throughout its entire depth was run about the middle of the vein and showed similar ore. In the cross-cut the galena is nearly 5 feet, and containing probably an average of 20 per cent. of galena that will run about 20 ounces silver per ton. In running the level here a good body of iron pyrites was encountered, being 2½ feet wide. The matrix is quartz, and the ore quite free from heavy spar.

The Champion and Way-up are on the same vein as the Belle of Ouray, while the Morton and Speculator are parallel veins. The ore in these veins is similar, except in the Speculator, where the ore is a gray copper, carrying from 40 to 300 ounces of silver per ton.

The Rose Group, one of the most promising properties in the district, is composed of four claims: The Rose, Golden Gate, Big Pigeon, Gold Finch, and Little Pigeon. The developments, so far as they go, show a good grade of ore, it being gray copper and galena, averaging 100 ounces silver per ton. The developments consist of a tunnel 270 feet long, one shaft 45 feet deep, a cross-cut 25 feet, and levels aggregating about 200 feet.

The Mineral Farm, owned by the Norfolk & Ouray Mining Company, is one of those properties that if worked would pay large dividends. The ore is high grade, being galena, sulphides, and pyrites of copper, and the running of drifts and level more than pays for so doing. Large quantities of low grade ore is stacked on the dump, and that alone would more than double the price of a concentrator, and pay all charges for reduction, transportation, &c.

About 10 miles below Ouray, at the confluence of the Dolores and Uncompahgre, considerable ground has been taken up and worked as placer claims.

*Red Monutain district* takes its name from a range of scarlet peaks, part of which extend into Ouray County and part into San Juan County. This is perhaps the most promising new mining district in Colorado; relating to this the following is taken from the description pamphlet of the mines of Ouray County by William Weston:

" Leaving Ouray for these mines you follow the course of the Uncompahgre River by the Bear Creek wagon road for 2 miles, and then turning to the right where Red Mountain Creek empties into the Uncompahgre River you follow the course of the former stream for 2 miles more in dense pine timber. At this point, 4 miles from Ouray and at an altitude of 9,300 feet above sea level, and just 2,000, higher than the town of Ouray, you enter a flat valley or park from a quarter of a mile to 1 mile in width and 2 miles in length, covered with a dense growth of willows and other shrubs and long grass. There are several small lakes in this valley, and a great deal of swamp or boggy land, Red Mountain Creek and its tributaries, among which are Gray Copper Falls Creek, flowing through it. The greater portion of this park seems to be underlaid with a bed of bog-iron ore of unknown thickness. On either side of the park is a high range of mountains and trachyte peaks, that on the west being the divide between the Red Mountain district and Imogene basin, in the Sneffels district, and that on the east being the divide between the Red Mountain district and the Uncompahgre district and Poughkeepsie gulch. I give these particulars so that any one looking at Professor Hayden's, Captain Wheeler's, or Thayer's maps may easily determine the precise location.

At the upper end of the Red Mountain park commences the chain of scarlet peaks from which the district takes its name, and we in the Sneffels district, which contains some of the richest lodes in the San Juan region, have always regarded the most prominent of these red peaks (at the foot of which are located the new bonanzas) as our volcanic center, the whole system of Sneffels lodes seeming to point or converge towards it. It will now be of great interest to recur to the following remarks on these Red Mountains by Professor Hayden in his geological and geographical report of Colorado of 1876:

"'On the point of petrographic character, this group presents more attractions than any of the volcanics. Many brilliant colors of the most delicate shades are shown by the mountains and ridges. They are due to admixtures of certain mineral substances. Dark colors may be said to be characteristic of the main bulk of this group, but a very prominent exception is made by what I have termed the "red stratum." Originally white, the presence of ferric oxygen compounds gradually changes this color to yellow, orange, red, and brown. The rock is a micro crystalline feldspathic paste of white color, containing very minute transparent crystals of sanidite and small crystals of pyrite. Throughout the district, wherever this stratum could be traced, the crystals of pyrite were contained in it as an impregnation. Decomposition of pyrite releases the sulphur and changes the iron from a bisulphide to hydrated sesqui oxide. This, in varying percentages, produces the colors and shades above enumerated.'

In another place he says, speaking of the discovery of mines made within the limits of the same group:

As significant I regard the presence of the red stratum. I do not mean to insinuate that such localities as do not exhibit it will be found barren of ore, but I am of the opinion that the bountiful mineral impregnation with which this group is supplied indicates the former existence of such causes as led to the formation of minerals that are classed as ores.

The ores are of two kinds, galena and a copper ore that looks like an antimonial copper glance; that from the Hudson mine being of a very dark gray color, in fact nearly black; that from the Yankee Girl being of a gray color and associated with copper pyrites, and that from the Orphan Boy having the usual beautiful colors of erubescite, and all these having the appearance of solid masses of metal, without gangue in them, and not having the combed or banded texture noticeable in all the ores of our vertical fissure quartz veins."

On the 14th August, 1881, John Robinson, while hunting in Red Mountain Park, picked up a bowlder, and, being astonished at its weight, broke it in two and found it to be solid galena. He and his three partners went to work and soon discovered the enormous ore body now known as the Yankee Girl mine. As no sides nor bottom could be found, they could not determine how the vein lay, and so staked off two other claims adjacent, naming them the Robinson and Orphan Boy. This comprises what is known as the Yankee Girl Mining Company. The company immediately put men to work and ore shipments began, and from that time to this no break has ever occurred in the shipments.

The ore-body is about 40 feet thick, and two men have stoped all the ore that with present facilities could be shipped. About twenty-five men have been employed on development work. There are in shafts and tunnels about 1,000 feet of development, which is being pushed with all the rapidity possible. The output for the year has been 3,000 tons of ore, worth $150 per ton, with a very high percentage of lead.

The Orphan Boy No. 2 is the name of a location above the Yankee Girl. A tunnel 65 feet long has been cut through 8 feet of very fine-looking galena. Work is pushed with vigor, and ore sacked for shipment.

The Little Annie, near the Yankee Girl, is a prospect that will be a producing mine before summer. The developments consist of a tunnel 90 feet long, a shaft 50 feet deep, and a drift 16 feet. The workings show a vein 8 feet wide of mineral that will run from $100 to $200 per ton, and this almost from the surface.

The ore is a gray copper and copper pyrites, in the same peculiar quartz rock found in the Yankee Girl mine.

The National Belle Silver Mining Company owns the National Belle mine. Although capable of producing 50 tons of ore per day this company has worked its mine with a view to thorough development, and what ore was taken out (700 tons) was removed in the course of development, the proceeds being used to defray expenses, which it has more than done.

The ore is of the same character found in this locality, viz, gray copper and copper pyrites, with a gangue of quartz. The following description is taken from the La Plata Miner.

"The force employed consists of 16 miners. The main tunnel or opening work is in 175 feet on a course nearly south from the face and directly under the discovery. In a distance of 125 feet is the large cave, about 100 feet in length. To the east side of this a chamber 20 feet in width has been excavated and the opening cleared out above to the surface, a distance of about 80 feet. From this work about 600 tons of ore have been extracted. In this same opening a shaft 4 by 7 has been sunk 30 feet, disclosing a mass of ore that the shaft fails to show any limit to. Water was found to come in too rapidly at the time this shaft was sunk to admit of going any deeper; since, however, the water has disappeared and it is the intention to sink at once and try to reach the level of a lower cross-cut now being run. At a point in about 100 feet from the face and on the west side of the tunnel a chute of ore and cave dipping down for 30 feet has been lately discovered and only partially explored. The cave so far as known is not of great extent. It is high enough for a man to stand in, but the bottom contains a pool of water. The same character of ore is found here as in the other caves. From the last 75 feet of tunnel a number of drifts have been thrown off on different ore chutes. One main branch from the tunnel in 75 feet, has a number of short branches, all disclosing an immense amount of ore. At a point over the main tunnel and in the main chamber is an ore chute bearing nearly west for 50 feet, whence it turns abruptly south, curving in its course back nearly to the line of the main tunnel for a distance of 75 feet, when it dips downward and opens into a large chamber. The opening along the chute referred to is in general quite small, barely admitting of the passage of one's body. The lower cross-cut is now in 135 feet, and the rock is rapidly changing, the porphyry being heavily charged with quartz, or rather, as we understand, is streaked with quartz. Good buildings have been erected for the accommodation of the men, and an ore house 14 by 44 gives good facilities for the handling of the ore. The output for the season has been about 1,000 tons."

The Mineral King has been shipping considerable ore. The developments consist of a shaft 36 feet; and a tunnel 100 feet the ore is galena, averaging 50 ounces silver per ton.

The Grand Exchange is about 1,000 feet from the National Belle. This mine has shown the most wonderful and varied mineral formations of any in the district. Iron and copper pyrites, galena, and soft gray carbonates of lead, sometimes separate and pure, again molded into fantastically shaped bowlders and nuggets. The development consists of a tunnel 120 feet long, and a shaft at the end of this 75 feet deep, from which a drift is run 23 feet. The ore averages 77 ounces silver per ton and 16 per cent. copper. No ore has been shipped, but at least 800 tons have been piled up on the dump.

The Hudson mine has a vein 12 feet wide of ore that will average $60 per ton without sorting. The character of ore is antimonial sulphide of copper, carrying silver and a small amount of gold.

The Charter Oak owned by the Treasure Trove Milling and Mining Company is being developed by an incline that at present has reached a length of 60 feet; also a drift that is 40 feet. The character of ore is antimonial copper and galena, scattered throughout the vein, and a quartz that carries considerable brittle silver.

Since December 1 a large body of iron carbonates and copper ore was struck in this mine and has been followed for 18 feet. The body is 6 feet wide and the ore has been sacked and assays made which show an average value of $200 per ton.

The Grand Prize, situated on the mountain east of the Yankee Girl, several hundred feet higher up, is one of the best prospects in the district. The work so far done is in a scattered way, but the future developments will be more systematic. A cross-cut is being run to tap the vein at the depth of 100 feet, after which a shaft will be sunk to connect, when drifts will be run each way on the vein. The vein can be traced for 900 feet along the surface and shows mineral for that distance.

The Saint Lawrence. parallel to the Hudson, is another of those lodes where the ore extracted in sinking the shaft has paid the expenses. At present the shaft is 50 feet, and from this 10 tons of ore were extracted, the character of which is gray copper and copper pyrites, that averages 60 ounces silver and 9 per cent. copper.

The Treasure Trove has produced some fine gray copper and galena ore that runs from 30 to 55 ounces silver per ton. The shafts and natural caves of this property aggregate 160 feet of development. The property is now worked under a lease, and the lessees, it is reported, are extracting large quantities of ore.

The Carbonate King, in Corkscrew Gulch, is favorably situated for working, being surrounded by fine timber and a convenient supply of water. The only development consists of a shaft 100 feet deep, showing a fine streak of pay ore, which is at present scattered, broken, and somewhat decomposed. Considerable ore is on the dump.

The Guadaloupe mine was only discovered in June, 1883, and is now a producer. The development consists of two shafts, one 35 feet deep, and the other 55 feet. In sinking these shafts 28 tons of one were extracted and shipped that ran 35 ounces silver and 35 per cent. of copper per ton. No blasting is required as the ore can be picked out with little trouble, and there are many tons in sight. This property promises to be one of the largest and most profitable shippers in Red Mountain district.

In the Jed mine, about one-fourth mile south of Ironton, the developments consist of a tunnel along a natural cave 140 feet. At the mouth of this tunnel is a shaft 30 feet deep, and at the end of the tunnel another shaft 40 feet deep. The character of the ore is principally sand carbonates and chlorides, although there are some copper pyrites.

The Saratoga lode in Albany Gulch was located in March, 1883. Since that time work has progressed steadily with good results. The property is developed by a tunnel 200 feet long. The first vein cut was a carbonate formation carrying $13 in gold and 10 ounces silver per ton. The second vein cut, about 3 feet in width, gave 24 per cent. copper and 14 ounces silver.

The third vein cut was 18 feet wide, containing pockets of sulphate ore that run from $100 to $200 per ton.

The Zuni lode on Anvil Mountain is the latest big strike. The shaft is

45 feet deep, showing a 7-foot body of ore. A tunnel 120 feet cuts the lode 80 feet below the bottom of the shaft, showing the same width in the vein. The ore is a high grade chloride, assaying 500 ounces silver and 4 ounces of gold per ton. Developments are being pushed, and shipments will begin as soon as a road can be built.

The Garibaldi is one of the latest discoveries, and it is thought will soon be a producing mine. The character of the ore is galena, with gray copper and copper sulphurets. This property was discovered in October, 1883, and only an open cut of 20 feet is on the vein exposing an ore in face 28 inches. Five tons were extracted in this 20 feet that will run 50 ounces silver, 12 per cent. copper, and 40 per cent. lead, per ton. This is a contact vein having a quartzite foot wall and a magnesia limestone hanging wall. The location is on Mount Abram, adjoining the Maud S.

The Maud S. is one of the wonders of this district. The vein is 24 feet wide, and, according to the Solid Muldoon, carries 5 feet of $200 ore, 3 feet of $100 ore, and from 5 to 15 feet of $50 ore. A drift was run on the vein 80 feet, when a shaft was sunk 24 feet, all disclosing solid ore. Fifty feet below another drift was run 115 feet, bearing in the same direction as the upper drift, and the two will be connected by a winze. Both levels disclose the same character of ore, and the vein in the lower level is 3 feet wider than in that above. The owners are at present shipping only enough ore to meet current expenses.

The Red Mountain Review, under date of January 5, 1884, gives the following estimate:

| | |
|---|---|
| Product of 1,025 tons ore shipped by agents Pueblo Smelting and Refining Company | $214,000 |
| Virginius mine, 300 tons | 69,928 |
| Munn Brother's mill, 250 tons | 47,531 |
| Bell Brothers' mill, 137 tons | 12,930 |
| Emma Mountain, 102 tons | 9,919 |
| National Belle, 980 tons | 69,600 |
| Hudson and Sailor Boy | 25,100 |
| Yankee Girl | 400,000 |
| Gaston | 57,500 |
| 1,200 tons from Grand Exchange and 180 other mines | 90,000 |
| Congress, 2,500 tons | 220,000 |
| Mineral King and 16 other mines, 1,500 | 112,500 |
| Shipments from Carbonate King, Galena, and others | 32,750 |
| Total | 1,761,758 |

The writer of the above has included the production of the Congress mine which is located in San Juan County.

The Mining Record gives the daily production of the mines of Red Mountain as follows:

| | Tons. | | Tons. |
|---|---|---|---|
| Yankee Girl | 25 | Hudson | 5 |
| National Belle | 5 | Congress | 5 |
| Robinson | 2 | Salem | 3 |
| Orphan Boy | 3 | Galena Queen | 10 |
| Gaston | 10 | Mineral King | 10 |
| Grand Prize | 5 | Monarch | 2 |
| Champion | 3 | Merrimac | 2 |
| Genessee | 3 | Galena | 2 |
| Ronvill | 2 | Blackstone | 2 |
| Little Anna | 2 | Joe and John | 2 |
| Galena Lion | 5 | Chattanooga mines | 2 |
| Sunshine | 5 | Delmino | 10 |
| Carbonate King | 5 | | |
| Mono Queen | 10 | Total | 152 |
| Jed | 3 | | |

Some of these mines are in San Juan County.

After a very careful comparison of the returns in relation to this and San Miguel Counties, I have estimated the production of Ouray County to have been for 1883: Gold, $20,000; silver, $500,000; total, $520,000.

Notwithstanding the loss of a large portion of its mining territory the production of Ouray County has more than doubled during the past year, the total production in 1882 having been only $230,000, of which $80,000 was gold.

### PARK COUNTY.

Park County occupies the South Park region and portions of the surrounding ranges of mountains. This region, especially the northern portion, is rich in gold and silver. Up to the time of the silver discoveries in 1871 the gold lodes and placers had produced about $2,500,000, principally obtained prior to 1866. The silver deposits are, however, of vastly greater value and extent. The argentiferous riches of the Mosquito Range are found in limestone and sometimes porphyry formations, a different condition from that existing among the northern districts of Colorado. Instead of fissure veins, deposits, chambers, and pockets of mineral are found, often between two formations. These deposits carry galena, gray copper, zinc blende, and a quartz gangue, or a heavy spar gangue. The mineral belt of this county is about 35 miles long by 14 wide, subdivided into five mining districts: Montgomery, Buckskin, Mosquito, Horseshoe, and Hall's Valley.

The first silver mine that attracted attention was the Moose, in 1871. The fall of that year saw a small army of prospectors on Mounts Bloss and Lincoln, and the following summer this was a center of great excitement.

*Montgomery district* is showing signs of life and many properties have been developed during the year, and by the opening of the season of 1884 the district will possess many new producers.

The Wheeler is being worked through three drifts on the vein. The first or upper drift is 105 feet long, with 40 feet of stoping; drift No. 2 is 94 feet, and drift No. 3 is 140 feet long. On drifts No. 2 and No. 3 no stoping has been done. The ore is free gold in quartz and is easily worked under stamps.

The Atlantic, an old producer, has been cleaned out and the developments pushed in every direction on the vein, which is about 2 feet wide, carrying free gold quartz that yields under stamps about $35 per ton. Numerous shafts, drifts, and levels open this mine to the depth of 160 feet, all showing a continuous body of ore.

McMartin's placer of 160 acres has been making extensive improvements in the shape of new ditches and a new system of hydraulic pipes. This property is among the first in this section as regards richness and no doubt will yield handsomely when once thoroughly worked.

The Little Annie Consol Mining Company's property on Mount Lincoln, has been doing but little work; so, also, the Lower Belt Mining Company.

The Russia mine, owned by the Russia Silver Mining Company, has been working about a dozen men continuously with good results. The vein is a contact about 20 inches wide, carrying galena, gray copper, and sulphurets.

The Mount Lincoln Silver Mining Company owns the Wilson and Lime mines. No work has been done on these during the year, and the ore extracted in 1882 still remains on the dump.

The Present Help mine, owned by Louis Dougal, is being rapidly put into good shape for extensive working in 1884. The shaft, now 55 feet deep, is being sunk to connect with a tunnel 150 feet long, that cuts the vein 20 feet. There are about 90 feet of drifts that are being extended; new openings are also being made. The formation is lime and similar to that of the Moose mine.

On the Fairbury new openings are being made, from which a large quantity of ore is being extracted, the old working being filled with ice. The ore is a high-grade galena, averaging 300 ounces silver per ton.

The Sacramento has been shipping some high-grade ore during the year, this being found in stringers and pockets. Developments are being continued and the property thoroughly explored.

The Pioneer Mining Company has been extensively working the Nova Zembla mine, and with flattering results. The ore is free gold and readily yields its precious metal under stamps. About 200 tons were treated at the company's mill. The shaft is 175 feet deep, having two levels; one, at a depth of 100 feet, is 60 feet long, and the other, at a depth of 150 feet, is 30 feet long. A tunnel has been run on the vein 75 feet, it being about 300 feet below the shaft. All these workings expose a vein from 3½ to 4 feet wide, with a pay-streak of about 12 inches.

The Kansas mine has lain idle some time, but was cleaned out and work resumed in September. This mine is one of the best developed in the district, and though the ore is low-grade, it is easily worked.

The Sovereign Gold Mining Company's property is on the eastern slope of North Star Mountain, and embraces four locations aggregating 6,000 feet on the old Harrington vein, which produced about $500,000 twenty years ago. The vein has a width of from 4 to 10 feet, its course being nearly north and south, with a dip to the westward of about 75°. The oxidation of the mineral extends from 25 to 35 feet below grass roots, where the ores in their original condition are found. Below this line the vein matrix consists of copper and iron pyrites and quartz-carrying gold and silver in profitable quantities. The ore is reported to range in value from $50 to $150 per ton. The development of the mine aggregates about 4,000 linear feet of tunneling and shafting, thoroughly demonstrating the strength and permanency of the lead. Several of the tunnels have been driven in on the vein from 200 to 300 feet, the deepest showing a solid breast of mineral 4 feet in width, that numerous assays have proved to be worth about $100 per ton. Another tunnel shows 3 feet of solid ore, while other openings show from 12 to 30 inches of excellent pay mineral. The lower tunnel is in 306 feet, and will be continued until a length of 2,500 feet is attained, which will open the vein 800 feet below the outcrop and highest workings. The operations of the mine being confined to opening it for a future production, the yield so far has been light. The dumps, it is estimated, are adorned with 3,000 tons of pay ore, to which additions are made daily, as development work advances. The shipments during the past season have been limited to small quantities of free-milling ore. Thirty days' work on this class of material, treated at a quartz mill, yielded 360 ounces of gold, worth nearly $7,000.

*The Buckskin district* is an old mining section, Mount Bloss supplying the greatest quantity of mineral at present. On a spur of Mount Bloss is the Melissa lode, a well-developed property that has been idle during 1883 on account of litigation. The ore is high grade, the mineral streak about 20 inches. The character of the ore lead carbonates.

The Fanny Barrett Mining Association owns fifteen claims. Its land extends from Buckskin Gulch over the crest of the hill to Mosquito

Creek, and covers an area of 7,500 feet in length by 900 feet in width. This property is developed by four shafts, from 50 to 180 feet in depth, and three tunnels, two from the Buckskin side and one from Mosquito Gulch; each of these tunnels is more than 150 feet long. The aggregate in drifts and winzes is more than 2,000 feet, all showing ore. No stoping has been done, the ore sold coming from development alone, in doing which forty-three car-loads were shipped.

The Red Lion possesses the same character of ore as the Fanny Barrett. The developments consist of a shaft 196 feet deep and about 350 feet of drifts. The ore streak is about 6 inches, but is of very high grade.

The Dolly Varden mine has not been worked during the year.

The Moose has been worked by lessees. Ore stringers are occasionally found of high grade, but most of the ore is too low to ship at a profit.

The Wyandotte has not been worked since July, the company waiting for machinery. Their location is on Democrat Mountain at the head of Buckskin Gulch, near the Kansas City, a district which is rapidly coming to the front as one of the leading heavy producers. The first work of any importance done upon the Wyandotte was in the latter part of last season. The present development consists of two tunnels of 100 feet each on the vein, about 80 feet apart. From these tunnels, in both instances near the entrance, shafts have been sunk, each being down about 50 feet. This is the bulk of the development now done, and for the small amount of money thus far expended makes an excellent showing.

The Little Ross is midway between the Dolly Varden, the Moose, and the Criterion contacts. On the Little Ross an incline, varying from 6 to 20 feet in width and 5 to 8 feet in height, is run in a distance of 240 to 250 feet. The vein is from 6 to 10 feet thick, of an almost solid ore body. Directly on the surface and for a distance of 50 feet in, almost the entire body runs upwards of $200 per ton in silver. The grade from this point in the next 100 feet is quite low, then at the breast of the present workings it advances to a point beyond the $200. The ore carries galena, gray copper, zinc blende, iron, and copper pyrites, and like the rich pockets of the Moose, sulphurets, with the addition of what the Moose never had, native silver.

The Everlasting mine, situated on Mount Bross, and a comparatively new property, is opening out into quite a bonanza. The mine shows a 3-foot contact vein of ore from which 15 tons were shipped, averaging $209 to the ton. The property is said to extend fair promises of becoming one of the best mines in Park County.

The Silver Dust is developed by an incline 48 feet, and a tunnel 188 feet long; the ore is high-grade galena and sulphurets, averaging $180 per ton.

The Fanny Morris is being put in order for production in 1884. A tunnel is being driven on the vein, which is, at present, 82 feet in length, showing a mineral streak, 30 inches wide, of gold-bearing quartz.

The Eureka is a quartzite formation; it is developed by two tunnels 52 and 15 feet, respectively, showing a 20-inch streak of mineral that averages 150 ounces of silver per ton.

The Silent Friend, Lexington, and Conry are being steadily developed.

The Wonderful, in Mosquito Gulch, is worked by lessees, who, it is reported, are doing well. They have opened a vein 4½ feet wide of quartz, in which is a pay-streak 14 inches, averaging $300 per ton in silver.

The Earnest and Little Earnest are being systematically developed; no ore has been shipped, but at present this property is capable of producing 50 tons of ore per day, with an average value of $35 per ton.

In *Mosquito district* the principal mine is the London. The following account of this property is taken from the Fairplay Flume:

"The London Mining Company owns five claims. The same organization, but under other titles, owns three claims as the Vienna Mining Company, three as the Rome Mining Company, and seven as the Berlin Mining Company, all patented and forming an unbroken line 4 miles in length upon what is termed in local parlance 'the great London vein,' which is believed to extend for 16 miles across the mountains in Park County. These companies are all wheels within the London wheel.

It should be understood that the London claim embraces two separate and distinct ledges, which run parallel and, on an average, 50 feet apart. The Blanchard tunnel, at the mouth of which are grouped all of the principal buildings, and where is located the machinery employed in working the mine, is 6½ by 7 feet in dimensions, large enough for two car-tracks, but at present only laid with one, and is timbered with square sets of 8 by 10 timbers, 5 foot centers, and filled with lagging of 2 by 6 plank. One can walk the entire length dry-shod. This tunnel was started at a cross-cut to the veins. It struck the east ledge at 540 feet and the west ledge at 50 feet more. It was carried on 150 feet farther, cutting in its course several feeder veins, but none that require particular mention, and work on the heading was suspended. Meanwhile a drift was started on the east ledge, and has been carried southeasterly over 900 feet, until it penetrated under the crest at the mountain and entered the Paris lode, which is one of the claims of the Vienna Mining Company. This point is 810 feet below the surface and 1,450 feet from the mouth of the tunnel, its outlet. This level had been driven 375 feet on a vein that averages 2 feet in width and is filled with a porphyry gangue, and with it more or less of quartz, that carries from eight-tenths to 5 ounces of free gold to the ton, according to hundreds of tests, when it encountered the famous fault or break of London Mountain. At the same time a drift was being driven parallel on the west ledge and at a distance of sometimes 20, sometimes 50, feet to the west, according as the veins slightly changed their course. This drift is also all in ore, but of a very different character. The vein is from 4 to 6 feet wide; the walls are even and marked, while the ore is a quartz with lead, copper, gold, and silver to the average value of $40 per ton, according to the assayer's daily record. This drift reached the same fault at about the same time as the east drift. This fault, by the way, carries a 2-foot vein of clay between its walls that bears free gold in paying quantities. But the question arose, Where have the veins gone? The enigma was partially solved speedily. In the heading of the east drift was a small streak of mineral. It was followed and in a few feet developed into a strong and continuous vein, but the character of the vein-matter was entirely changed and resembled more the mineral in the west ledge. This has given rise to some interesting conjecture, whether the so-called break may not be merely a fault, the whole south side of the mountain having slid east and downward. If so, the east ledge may still be found to the east. In time it will be prospected for in that direction. But the vein already found was deemed satisfactory, and is treated as a combination of the two veins. This vein averages 24 inches in width and is much richer than before the fault was reached. It has been proven 180 feet within the Vienna company's lines, and here stoping will commence. The arrangement is that for a certain payment the latter has right of way through the London openings for fifty years. Eventually this drift will be carried to the surface on the southern slope of the mountain.

There are numerous other openings on this level, such as cross-cuts between the two ledges, upraises, and in particular we might mention three openings of no little importance. The first is a drift 150 feet on the Grant vein, a small but rich vein that takes off from the east ledge in a southerly course. The second is a winze sunk to a depth of 75 feet on the west ledge, and which tapped the east vein. Being below the level of Mosquito Creek, the first water in the mine began to come in. The winze proved the continuity of the east ledge at this depth and the increased richness of its ore. The third is a drift on the west ledge 180 feet northwest from the Blanchard tunnel. It has disclosed some bodies of ore similar to those in the south drift. Some fine stoping-ground has been laid out and just opened into on this level, and several hundred tons of ore are lying broken in the drifts. The only connection between this and the upper level is by a winze, 260 feet, which was sunk on the west ledge, and serves both for ventilation and as an ore chute, carrying all ore stoped out above to the lower levels, where it is loaded into iron cars, holding each a ton, and carried forward to the ore-house and dumped close to the revolving drum on the tramway.

Regarding the workings at the next level, called the middle tunnel because the original owners ran in another tunnel on the ledge several hundred feet higher on the mountain not in use by this company, space will not allow us to go into minute detail. This tunnel was started on the vein (west ledge) by the former owners. The London company pushed it along the vein 500 feet, and reached the fault or break. The heading was carried 30 feet into the quartzite face of the break, and there stopped. A drift was run west on the fault 30 feet to find the other vein, the winze having not yet proved which vein the tunnel was on. A drift east on this line is now searching for the east ledge, known to exist 25 feet below. Below this middle tunnel two levels have been run from the winze that forms the ore chute to the lowest level. From these comparatively small openings all of the ore required by the mill is stoped with ease.

In the first of these levels, known as the 25-foot level, is a drift 100 feet long on the east ledge. In the second, known as the 50-foot level, are drifts to the length of 75 feet upon the west ledge. The stopes here are extensive, and it is easy to see that the veins where the ore has been exhausted have been uniformly from 3 to 7 feet wide. In one or two cases where the ore pinched the ground is left standing, as a key or pillar to save timbering and to keep the ground from caving, but for the most part the ore has been replaced by heavy timbers in order to afford security to the men.

The stopes above are still more extensive, being 200 feet long and 30 feet high. All of the ore that is coming out now is supposed to be largely free-milling, and goes direct to the mill. An upraise from the tunnel from here to the surface, 100 feet, furnishes good air at all times. The temperature of the mine is uniform, also, at about freezing point, making it comfortable to work in. The changes of the seasons, or from day to night, make no appreciable difference under ground. In this description we have noted only the principal openings. There are many more of minor importance, but which go far to make up the sum total of development.

To recapitulate: There are no less than 4,500 feet of development in tunnels, drifts, and winzes on the mine, and it may be said that they are all in ore except the Blanchard tunnel and a few unimportant cross-cuts. Nearly a mile of development and more than half a mile of ore veins have been opened up. There is something over half a mile of track laid in the mine, and about 7,500 feet of compressed air and ventilating pipes. The expense of breaking a ton of ore and landing it in the ore-house is estimated at $3.60. Twenty cents more will land it in the ore bins at the end of the railway by means of the automatic tramway. Then there remains to be figured in railroad transportation for 8 miles to the mill and cost of milling. The outside cost of everything per ton would probably not exceed $7.50. Forty-one men are on the pay-roll at the mine.

In seven months and a fraction since the stamp and concentrating mill commenced running at the Junction it has crushed about 6,150 tons of ore, or a monthly average of 850 tons. This ore has yielded gold bullion to the amount of $124,000. It has also yielded about 420 tons of concentrate, worth $60 a ton on an average, or a total of $25,200. About 15 cars or 210 tons of high-grade ore have been shipped out to smelters, worth at least $21,000, and it will be remembered that early in the year the London shipped 600 tons of ore to the Idaho Springs and Central mills, which yielded an average of $18 a ton, or $10,800. This swells the total production of the mine to a trifle less than 7,000 tons, worth $181,000. We are aware that this figure will be by some considered an overestimate, but we believe it to be substantially correct. The London steadily employs a force of sixty men."

West of the London is the New York mine, worked by Felix Leavick under lease. About ten men have been working steadily. Considerable ore has been taken out.

The Sunny South has been idle most of the year on account of litigation. The ore found in this mine is very rich, carrying considerable wire and native silver. The only developments consist of a tunnel 100 feet on the vein.

The U. P. and K. P. mines are developed by 550 feet of tunnels run on the vein, with sundry shafts connecting with the tunnels for ventilation and convenience in working the mines. This is one of the regular steady producing properties in Park County, the vein being from 4 to 6 feet wide, the ore averaging $75 per ton.

The Boaz Mining Company consists of five claims, namely: The Charles XII, Centennial, Mountain Star, Louisiana, and Stella. The company has made arrangements to work all the properties from this time on. A lower tunnel has been driven in on the Charles XII to cut the ore body struck in the upper tunnel. A mill-run made from the ore gives 251 ounces in silver, 2½ ounces in gold, and 14 per cent. lead. A second mill run gives 130 ounces in silver, 4¼ ounces in gold, and 6 per cent. lead. A large force of men are working and developments are prosecuted with vigor. The present developments consist of three tunnels on the Charles XII lode, 225, 50, and 185 feet long, respectively: the Centennial by two tunnels 20 feet and 50 feet long, respectively; the Mountain Star by one tunnel 50 feet long and a shaft 20 feet deep; the Stella by two shafts, each 40 feet; the Louisiana by a shaft 45 feet deep and a tunnel 55 feet long.

The 225-foot tunnel on the Charles XII is on the contact vein, and the other tunnels are on the fissure. All the workings on the other properties are on fissure veins.

The property of the Weston Consolidated Milling and Mining Company, consisting of seven claims, is situated on the eastern slope of Pennsylvania Mountain. The principal work has been done on the Hock Hocking and Weston mines, and consists of shafts and levels which aggregate 2,000 feet in length.

The Pine Tree Gold and Silver Mining Company's property is developed by a tunnel 380 feet long, an incline 60 feet and one shaft 65 feet. The vein is 6½ feet wide, of decomposed quartzite, running about $30 per ton gold. This company has given out a contract for the erection of concentrating works, and after this is built the property will probably be a large producer.

The Bonanza King is developed by a shaft 115 feet, showing a pay streak 4½ feet wide. Water stopped work in the shaft and a tunnel was commenced, which, at present is 80 feet long. The ore is high grade, and that extracted in developing is paying all the expenses.

Near the North Star Mine is the property of the Liverpool Mining Company, that is pushing developments and opening its mine for a large production in the future. One main tunnel is being driven, which at present is 100 feet long, and at the same point levels are run 106 feet west and 116 feet east. The west level is connected with the surface by a shaft 56 feet. The ore is a decomposed quartz and iron pyrites carrying free gold, the average per ton being $50.

The Turman, owned by M. A. Lawrence, is being worked through a tunnel on the vein 295 feet in length. This will connect with a shaft 83 feet. The ore is high-grade quartz, the width of vein about 4 feet. The dump contains about 70 tons of ore that will average $300 per ton.

The Detroit, near the Turman, is developed by a shaft 22 feet deep and a tunnel 18 feet long. The vein is about 12 feet wide, carrying free gold in white quartz, streaked with dark copper stains; value of ore from $30 to $75 per ton.

On South Mosquito Gulch, the Hancock and Ollie are being worked. The Ollie has two well-defined vertical fissures; the developments consist of two tunnels 25 feet and 35 feet long, respectively. The veins are from 2½ to 3½ feet wide, with average value of ore about $50 per ton. The development of the Hancock is a tunnel 40 feet long.

The Weston Mining Company has been steadily developing its property, which embraces the Winchester, Montgomery, Robert Keeley, Gold Leaf, Silver Leaf, Illinois, Ensign, and Blue Grass lodes, covering a strong vein for a distance of 2,500 feet. Twelve openings have been made on this vein, ranging in depth from 15 to 130 feet, the average width of the vein being 6 feet. There are now about 1,000 tons of ore in bins and on the dumps, from which a lot of 11 tons was selected and shipped without sorting, returning $23.55 per ton in silver and gold, no account being taken of the lead and copper. The mineral is well adapted to concentration, the specific gravity of the various metals permitting a ready separation of the different constituents of the ore and the entire elimination of all the waste rock or gangue. In consideration of this feature the company proposes to erect a concentrating mill, with capacity of 50 tons a day, and has already begun grading with this object in view.

The Danser mine has been producing steadily; although the ore is of low grade, it is of that nature that it is economically concentrated. Since September, when shipping was stopped, the owners began a thorough course of development to put the mine in good shape for the coming season.

In Horseshoe district, the East Leadville Mining Company, formerly the McLean Mining Company, own, in addition to 960 acres of patented mineral land, the Mudsill, Little Johnny, Revenue, Michigan, Fadet, Fanchon, Madelon, Speculator, Sandstone, and Vulcan or 200 more acres. Most of the developments are on the Mudsill mine, and show one of the lagrest mineral veins in Colorado, consisting of a dry and free milling ore, carrying chlorides and silver glance. The developments consist of three drifts, viz, No. 1, 150, No. 2, 280, and No. 3, 650 feet long; one level 125 feet, and a shaft 400 feet deep. In addition the company has started a lower tunnel to cut the vein 900 feet below the apex of the lode. A shaft is also being sunk, known as shaft No. 7, in the southwest of the northwest quarter of section 7, one of the mineral sections owned by this company. It is the intention of the new corporation to erect an amalgamator at the foot of Mudsill Hill and in close proximity to the No. 7 shaft referred to, the plant to be very much like that of Taylor and Brunton's amalgamator of Leadville.

The Last Chance has given employment to half a dozen men, working constantly on development. A tunnel 170 feet connects with a shaft 65 feet deep. At least 1,700 tons of ore have been extracted during the year. But a small quantity was shipped, and that averaged 40 per cent. lead and 40 ounces of silver per ton. Active shipments will begin in the spring.

The Grand View, Badger Boy and Winda have been worked but very little.

The following account of the mines of Hall's Gulch district is furnished by W. Bowen Iwans.

"*Hall's Gulch district.*—This district is destined to be one of the most prolific producers of Park County. It lies north of the Kenosha Mountains, between them and the foot-hills jutting out from the Continental Divide, in a basin thus formed, with the mines lying against and upon the main range. New discoveries have been made, and the outlook of the camp is most promising, although but few properties are being actively developed.

The Whale mine has four levels on vein; aggregate development about 3,300 feet; ore body continuous throughout; only a small force of men has been employed averaging 9, partly in development and partly in extraction of ore; ore, argentiferous galena, with gray and yellow copper; average assay, 375 ounces silver per ton and 20 per cent. lead; average width of pay, 10 inches; company owns three other patented mines, but has only worked above during past season; total weight shipped, 232½ tons; gross value of production, $24,515.85.

Leftwick.—About 2,500 feet development by 6 adit levels; no work done during past season.

Comet and Adriatic.—About 500 feet of development on each by cross-cut tunnel and shafts; no work done during past season.

All the above mines are owned by the Comet Consolidated Mining Company of Colorado. All are patented properties.

Great Eastern.—Shaft is down 175 feet with 10 to 15 inches of continuous ore, carrying gray and yellow copper; average assay, 150 ounces silver per ton and from 10 to 15 per cent. copper. At 100 feet down a level has been run 100 feet on ore the entire distance. Not much ore has been shipped from this mine, mostly development work having been done during past season. Owners, Hall's Gulch Consolidated Mining and Tunneling Company.

Bullion Mountain Silver Mining Company owns the Chase property, one of the most promising mines of the district. The Chase has a tunnel 385 feet on the vein, with 6 to 10 inches pay streak; assay value as high as $1,300 per ton. Ore, argentiferous galena, with a small streak of native silver and sulphurets of silver. A 95-foot shaft has been sunk during the past summer; but little ore has been shipped from this mine.

N. B.—The above property is situated in Gibson Gulch.

Hope.—This property, situated in Gibson Gulch, is a most promising prospect. There is a shaft 150 feet deep, also two tunnels 20 feet and 45 feet, respectively. Ore mills heavy in lead and about 100 ounces in silver; is owned by parties in Dubuque, Iowa.

Venus has a drift 45 feet long on the vein, with galena scattered through the quartz and clay gangue; average assay, $110; Jim Tracy and J. W. Grow are the owners; only development work been done past season.

Weehawken.—Situated on Bullion Mountain; an adit 60 feet long has been run on the vein and a shaft 30 feet deep; pay streak 12 to 20 inches wide, disclosing gray copper and milling 50 to 120 ounces in silver, with 15 per cent. copper; owners, Discon L. Southworth and company.

Madagascar.—Located on Bullion Mountain; has one tunnel 125 feet long; ore mostly argentiferous galena, with some gray copper; pay-streak 10 to 14 inches wide; property is patented and owned by Upper Platte Mining Company.

Cumberland.—This is another fine piece of property. It is developed by a shaft 75 feet deep and a drift 30 feet; the ore body is continuous, pay-streak 12 inches wide, and the vein 10 to 15 feet in width; mill-runs obtained from this ore ran $135.

Jay Gould.—Tunnel in 75 feet (another remarkably good claim); no ore has been shipped; several assays made ran from 50 to 300 ounces; gray copper and galena are the ores; both of the above properties belong to James Tracy.

Missouri.—This mine has an established reputation as a producer, having shipped considerable ore up to the past season. Developments consist of a shaft and about 600 feet of tunnels on the vein. The fissure is from 20 to 25 feet wide. Pay-streak from 4½ inches to 22 inches wide; average value of ore 125 ounces silver, and has carried as high as 10 ounces in gold. This ore carries silver, gold, copper, iron pyrites, and bismuth; also gray copper; but very little lead is in this ore, which is rather strange, as every mine in the camp carries lead to a great extent.

Occident.—This property has been most faithfully worked by S. M. Davidson, it present owner. It has a tunnel 600 feet in length, showing up a well-defined fissure, the vein being 12 to 15 feet wide, with a pay-streak of 9 inches, ore averaging $70 per ton. When a tunnel was driven in 100 feet, a large body of decomposed iron pyrites was encountered, which averages 1½ ounces in gold and a trace in silver. This property has also a shaft, sunk 16 feet on the vein.

Ypsilanti.—This is one of the best mines in the camp. During the past summer this property has been most extensively developed by the Ypsilanti Mining Company. The mine is worked by two tunnels and two shafts, also an 'upraise.' Tunnel No. 1 is in 200 feet; tunnel No. 2, 445 feet, the first 83½ feet in the latter being a cross-cut; No. 1 shaft is down 59 feet, with 30 feet of drifting on the north and 25 on the south; No. 2 shaft is down 15 feet; the 'upraise' is worked out 32 feet. In shaft No. 1 ore was 'struck,' which mill-runs 1,000 ounces silver; the vein is 25 to 30 feet wide, with three streaks of solid gray copper and native silver intermixed, largest streak being 16 inches wide, smallest 10. Ore in tunnel is nearly all galena, with native silver, and a small amount of gray copper; average run of this ore, $90. In shaft and drift but very little galena was noticeable; ore mostly gray copper (solid) (in massive form—not the regular tetrahedral crystals), native silver, and ruby silver. But 6 car-loads of ore (62 tons) have been shipped from this mine during past season, most development work having been done

For some time a force of 50 men was employed. This property is now owned by Quincy parties, mining under the name of the Ypsilanti Mining Company.

Concentration Works.—The Quincy Milling and Reduction Company has leased the mill and buildings of the Upper Platte Silver Mining Company, and has placed therein a fine plant of machinery for the concentration of ores of surrounding district. The plant consists of two batteries (10 stamps), three tables of the Embrey style, also two pans, and one large 'settler,' besides a retort for amalgamating purposes. Public sampling is also done at these works. Owing to the lateness of the season, when the mill was ready to run, but very little concentrates were shipped. Gross amount, 130 tons; average run of concentrates, $90 per ton. Works are shut down for the winter owing to the scarcity of water and no steam in the works; machinery run entirely by water-power.

Further up the gulch Messrs. McGowan and Oberkircher have erected a complete little concentrator, having in place a 5-stamp battery and two Frue Vanner tables, with ample power to enlarge their works to any extent demanded by their patronage.

"The Little Lake group embraces the Earl, Little Lake, Duke, and Chicago. The developments consist of a tunnel run 328 feet, showing in the breast a fissure vein 22 feet wide and vertical. The ore is a quartzite running about $35 per ton. Over 200 tons have been removed in making developments.

"The Gold Placer Mining Company has not been working during the year. The Alma placer has produced some gold, as also the Pease and Sidell placers, the latter being more in a condition for extensive workings, many new improvements having been put on the property during the past year."

The production of this county in 1883 was: Gold, $200,000; silver, $175,000; total, $375,000.

## PITKIN COUNTY.

Pitkin County is in extent about 60 miles from east to west, and 35 from north to south. Considerable development work has been done on its mines, but the production from them has been small. The smelters have not worked well, and the trails being bad, the transportation charges leave but a small profit to the owners of the mines.

Of the formation of this country, or rather of that in the vicinity of Aspen, the Rocky Mountain Sun says:

"Although the silurian belt of the Aspen district, as shown by Hayden's map, is rather a narrow one as compared with that of other districts, it nevertheless presents a more numerous and a greater variety of strata and contacts than are found in wider exposures of this formation. The reason of this is apparent when we consider the angle at which the strata is upheaved. There are as yet no deep workings in any of our mines by which to positively determine the dip of the geological formations of this vicinity, but the combined testimony of the exposed strata and limited development in the mines is that it is about 60°, and that the dip is toward the west.

The Smuggler mine, which is located not more than 200 feet above the valley level, and which, from the nature of its surroundings, ought to indicate with considerable certainty the dip of the formation, stands at an angle of 60°. Of course the steeper the dip the greater the exposure of strata and contacts within such exposure. Mining men, who only know the Aspen mineral belt as it appears on Hayden's map, would be surprised, when they come to practically inspect it, at the number of contacts shown and the uniformity with which most of them inclose valuable minerals. The silurian rocks of the Aspen district are identical with those which appear in Gunnison County, from whence they run along the westerly side of the Continental divide in a northerly course past Ashcroft, through Aspen, and thence across the head of Frying Pan, thence swinging a little more to the west and circling eastwardly to Red Cliff and on to Leadville. At Red Cliff and Leadville the formation is nearly flat, the tilting up being not so great as at Aspen.

Returning to the consideration of strata exposed in this vicinity through the upheavals and erosions of past ages, we find them in the following order: Eastward from Aspen about one mile are old granite rocks, and thence westwardly in the order of their naming are the lime, quartzite (narrow), brown lime, blue lime, black lime, porphyry, lime, quartzite, black shale, lime, porphyry, gray lime, red sandstone. Within the limits of each of the contacts formed by these strata are valuable mineral deposits.

Smuggler mine.—This is a 40-foot vein of mineral inclosed between a blue lime foot wall on the east and a black shale hanging wall on the west. East of the foot wall is quartzite, and west of the hanging wall porphyry. The vein contains two nearly distinct characters of ore; that adjoining the hanging wall is a steel-grained galena interspersed with considerable native silver in leaf and wire forms, and occasionally showing gray copper. The foot wall mineral measures 25 feet horizontally at right angles across the vein, and is one of the largest and most uniform bodies of pay ore in Colorado; it averages 30 ounces of silver and 20 per cent. lead. It has the appearance of a light lime gangue interspersed with galena, and for a long time it was supposed that was really its character; analyses have proved, however, that the supposed lime gangue is a carbonate of zinc. Of course this is a temporary disadvantage, because it interferes with the otherwise easy smelting quality of the ore. No 'black jack' (zinc blende) is observable in the Smuggler ore. The silver and lead are easily separable from the carbonate of zinc by concentration, and thereby a valuable and easy smelting ore can be obtained.

The Spar mine.—This mine lies lengthwise of a small ridge on the north side of Aspen Mountain. The apex of the ridge is formed of a large stratum of hard, blue limestone about 100 feet in thickness, and forms the hanging wall of the vein; chemical analyses show this limestone to contain about 98 per cent. of pure carbonate of lime. The mineral in the vein is separated from this hanging wall by the usual 'slickensides,' gray in color. The vein is from 1 to 16 feet in thickness, and contains baryta (heavy spar), iron, short lime, silver, &c. The foot wall is of short or block lime, so named from the fact that it always breaks into cubical fragments; it contains about 30 per cent. magnesia. The horizontal strike of the vein and its accompanying walls is south 74° W., while the strike of the apex of the vein is south 30° W. The south end of the claim is 725 feet higher than the north end, which accounts for the difference of 44° between the horizontal strike of the vein and its apex on the surface. The vein is without faults or breaks of any kind whatsoever, and dips north 16° W., at an angle from the horizontal, varying from 23° 30′ to 40°. About $40,000 has been spent developing the property. Nearly 2,000 feet of exploration has been done. Mineral more than sufficient to pay all expenses has been taken out.

At least 30 men will be kept constantly at work developing and extracting the ore, which assays from 10,000 to 19,000 ounces in silver, and from 3 to 50 per cent. lead.

Camp Bird Group.—This group comes next in order, and is near Tourtelotte Park; it was located during the fall of 1879 and spring of 1880. It consists of six claims and one mill site. They are the Camp Bird, Iowa Chief, Edison, Silver Star, Grand View, and Burro. The four first mentioned lay side by side, forming a block 1,200 by 1,500 feet square. The two last, Grand View and Burro, are attached to the end lines of the others, and extend 1,500 feet further in a northerly course, and are also side by side, thus making the group somewhat of an L shape. These properties have had some $16,000 worth of development work done on them, the Camp Bird having $8,000, and the remaining $8,000 being nearly equally divided between the other five claims. The Camp Bird is located on an out crop, the vein running through, or nearly through, the entire claim. This property has produced something over $10,000 in mineral, the smelter returns being from 64 to 495 ounces silver per ton. The work was discontinued on the mineral here because of foul air; the owners are now sinking an air shaft, and as soon as it reaches the old workings work will again be started up more vigorously than ever.

This, beyond doubt, is the Spar vein, as it is easily traced from the Spar mine through the Durant, the Ruby, the Bob Ingersoll, and the Camp Bird, a distance of over 7,000 feet, and is called by miners a contact. The foot wall is a dark brown lime; the hanging wall is a dark blue lime, and entirely dissimilar from that of the foot wall.

The Grand View, also a very promising property, has a vein 2 feet thick passing lengthwise through it and is well defined between walls of dissimilar lime. This is an extension of the Jenny Lind vein, from which assays as high as 3,000 ounces per ton have been had. The other four claims have each small veins, and are not as encouraging as the two first mentioned. This group, perhaps, is the best located and most attractive on Aspen mountain, because it covers a good mineral section and is free from litigation.

The Morning and Evening Stars.—This property is the finest development in the quartzite belt. The amount of ore on the surface is about 60 feet wide. It has been faced about 10 feet deep, and the tests made on the same show it to be first-class concentrating ore, and reasonably will return 24 ounces to the ton. This body of quartzite has been prospected for 600 feet south of the present workings; this in itself shows this to be a large and valuable mine. At a considerable depth there has been a tunnel run through the quartzite to the upper contact of lime, where there is about 3 feet of mineral running 100 to 400 ounces in silver per ton.

Castle Rock Mining and Milling Company.—These properties lie south of the above lodes and cross the lime and quartzite belt. There are eleven full claims. In early times this property attracted much attention from the discovery of rich quartzite float that ran as high as 16,600 ounces to the ton. The developments consist of 2,500 feet of tunnels, shafts; amount expended is $30,000. The work has never ceased during the past two years. The results show at the mouth of the Dubuque tunnel a belt of mineral 40 feet in width in lime, running from 2 to 80 ounces per ton, averaging about 12 ounces. This ore will concentrate 4 tons into 1.

Two hundred and seventy feet from the entrance of the Dubuque tunnel is the Johnson vein of steel galena with antimonial sulphide of copper, spar, and pyrites, running well in silver. The vein at present is 36 inches. The last ore taken out assayed 175 ounces silver, and 33 per cent. lead. Stoping out mineral at the tunnel level was commenced, but the foul air caused cessation of work. They are following the vein from the surface, and will connect with the tunnel below, a distance of 96 feet; the ore will then be stoped out, and taken through the Dubuque tunnel.

The Centennial tunnel was started to cut the upper contact of the quartzite. They are in 390 feet and may reach the intended point at any time, tapping the same mineral the Stars have on the same contact. They are now working 6 men, and will continue the work to completion.

The Late Acquisition has a tunnel 165 feet, tapping a well-defined vein of low-grade ore 6 feet in width. A winze has been sunk west of the vein to a depth of 30 feet. Ore mill runs from 12 to 25 ounces silver, and 50 per cent. lead.

The Buckhorn Group.—This group consists of four claims, the Buckhorn, Castle No. 2, Chicago Times and Tribune, situated on the extreme south end of Aspen Mountain, in what is known as Tourtelotte's Park. These claims were located in 1879. The formation on this part of Aspen Mountain is similar to that on the northern end, though the lime belt is much narrower. The principal work done during the past year was on the Buckhorn, and consists of a shaft 65 feet deep, and a drift running from the bottom of the shaft for a distance of 124 feet. The most of the work done in the shaft was in wash, though the last 20 feet appeared to be in solid formation. In the drift at a distance of 16 feet from the bottom of the shaft a well-defined foot wall was encountered and also a small vein of mineral. The drift was continued along this wall for a distance of 28 feet, more or less mineral being encountered all the way. From this point a slight deflection was made from the foot wall to the left in order to determine the position of the hanging wall; this drift was continued for 30 feet, the mineral gradually increasing in width until at this point it was 3 feet wide; it kept about this width as the drift was continued, until within 10 fee of the present face, when it widened out to 6 feet, and the last 10 feet shows nothing but mineral. Work will be pushed on this mineral until both the hanging and foot walls are encountered. It is impossible to tell the width of the vein, but from the present indications it would be at least 12 feet wide. The mineral consists principally of spar and carbonate of lead, averaging 40 ounces silver and 50 per cent. lead"

Around Ashcroft the mining interests have not been great in the past, but the future looks promising. Since the first of the year the Montezuma has begun to deliver on a contract made with the smelter at Aspen, and other properties are being put in shape for a more extensive development.

On Slate Mountain is the famous Montezuma. Over 3,000 feet of work has been done, and the company has shipped in the neighborhood of 1,000 tons of ore, averaging from $60 to $65 per ton. Forty men are at present employed on the mine, and the work is being continually prosecuted.

The Waterfall group, consisting of the Waterfall and New Discovery, is situated on Slate Mountain, at the forks of the Montezuma and Crested Butte wagon roads.

The Waterfall has a 5-foot vein, the whole averaging about 30 ounces in silver, with a small streak running 1,500 ounces. This claim has been developed by an 80-foot tunnel.

The New Discovery, joining side-lines with the Waterfall, has an 18-

inch pay-streak, assaying 40 ounces in silver, developed by a 20-foot tunnel and a 30-foot shaft. Both of these claims are patented.

Joining on the north end line of the Waterfall, and on the Montezuma road, is the Paulina group of claims.

The claims of this group consist of the Little Paulina, which has been patented, the Ruby, an extension of the Paulina, the Contention and the Berlin.

The Paulina is one of the largest veins on Slate Mountain, being fully 50 feet wide, with an immense body of 25-ounce mineral cropping the whole length of the claim.

The Contention has a 5-foot vein with an 18-inch pay-streak, running 30 ounces in silver.

The Berlin has two veins, one 4 feet wide with a 12-inch pay-streak, running 27 ounces in silver and 1 ounce in gold. The other vein is 5 feet wide, averaging three-quarters of an ounce in gold and 20 ounces in silver.

On the west side of the mountain is the Yellow Boy group. This group consists of four claims and two fractions, to wit, Yellow Boy, North Star, Inez, and Bon Ton, all patented.

The Yellow Boy is a 12-foot vein with a 20-inch pay-streak assaying from 25 to 80 ounces in silver and 46 per cent. lead. This claim is developed by a 150-foot tunnel.

The North Star is a 4-foot vein with a 12 to 18 inch pay-streak, from which assays have been made showing as high as 587 ounces in silver and from 30 to 60 per cent. lead. This claim is developed by a 125-foot tunnel.

The Inez is an 85-foot vein, and assays as high as 756 ounces in silver, and contains 30 per cent. lead. This claim is developed by a 75-foot tunnel.

The Bon Ton is a 5-foot vein, with a 12-inch pay-streak running 45 ounces in silver, and contains 20 per cent. lead. This claim is developed by a 70-foot tunnel. The fractions lie in the group, and also show some excellent mineral.

The following description of the mines of this section has been kindly furnished by Fred. Maxwell, esq., of Quartez, Gunnison County:

"Ashcroft, in *Columbia mining district*, first settled in 1880, is located in a beautiful park on the right bank of Castle Creek, and is surrounded by Taylor and Elk ranges. Although little development has been done on the mines, those who have opened up their properties have been handsomely rewarded. One drawback has been the heavy expense of shipping mineral. This year a wonderful change has taken place. Not only has a fine road been made over Pearl Pass (25 miles) to Crested Buttes, but an ore market has been opened at Aspen, 12 miles distant. These enterprises will give a new impetus to mining in this section. Shipments of ore will continue all winter, giving employment to a large number of men and teams. True fissure veins are here found carrying high-grade galena, gray copper, and silver ores. The formation is granite, lime, and sandstone.

The most promising mines are Montezuma, Tam O'Shanter, Michigan, Wichita, Leona, Cummings, Highland Chief, Yellow Boy, Eureka, Alcyon, Pearl, Minneapolis, Osborne, Southern Home, Champion, Sedalia, Burton, Saint Elmo, Unexpected, Keno, Waterfall, Hidden Treasure, Copper Chief, and Grand Union. The first named has produced heavily. A large amount of mineral has been taken out in this district and allowed to lie on the dump, awaiting means for transporting it, which at last are at hand. In this section the veins are large and well defined, varying from 4 to 18 feet between walls, and the greater part carrying high-grade ore. The depression in lead has not affected this district so much as other sections, the smelters at Aspen having bought steadily.

It is a well-known fact that the best mines are near the top of mountains, or above timber line. The ores of Conundrum Gulch are mostly free-milling. The smelting ores are heavy galena.

The Montezuma and Tam O'Shanter were discovered in 1880. Fifty men have been constantly at work throughout the year on these two mines. The Montezuma is shipping its ore to Aspen for treatment, a large amount having been sent outside over Pearl Pass. On this mine about 1,500 feet of work has been done, consisting of tunnels, drifts, and shafts. The ore has milled 65 ounces of silver and 35 of lead. On the Tam O'Shanter a large amount of work has been done; the ore milling 80 ounces of silver.

The Michigan, on Slate Mountain, has 26 inches of pay mineral, and has shown up finely this year, although not much work has been done. A mill-run gave 67½ ounces of silver and 4 ounces of gold.

The Leona, discovered in the spring of 1882, has been steadily worked ever since. The vein is 3½ feet wide. It has a shaft of 35 feet and a tunnel of 65 feet. It mill-runs 98½ ounces of silver.

The Highland Chief, on Slate Mountain, has very rich black sulphurets.

The Wichita, on Slate Mountain, has 350 feet of work done. It shows a large and rich vein of mineral.

The Yellow Boy group, also on Slate Mountain, has nearly 500 feet of shafts, tunnels, and cross-cuts. The group comprises Yellow Boy, Suez, Bon Ton, and North Star. They cross and overlap the Tam O'Shanter some 300 feet.

The Alcyon mine, on south side of Pearl Mountain, is an extension of the Pearl and is a very promising property.

The Pearl group, on Pearl Mountain, is composed of the Pearl, Hoosier, Extension, and others. The main workings are on the Pearl, and consist of a tunnel 100 feet in length and two drifts of 30 feet. It abounds in silver glance and brittle silver.

The Cummings mine, in Conundrum Gulch, has a vein between 2 and 3 feet wide, consisting of quartz, gray copper, and brittle silver. The vein shows up strong at every point.

The Southern Home, also in Conundrum Gulch, is a property similar to Leona.

The Philadelphia group consists of the Creedmoor, Pan Handle, Bismarck, Paulina, Berlin, Waterfall, and New Discovery, located on Plate Mountain. The ores are galena, except in Waterfall, where they are high-grade copper.

The Sedalia group, on Slate Mountain, consists of the Sedalia, Burton, and Elizabeth. On the Sedalia is a tunnel of 175 feet, and on the Burton a 90-foot shaft, and other workings. The ore is galena and gray copper.

The Saint Elmo mine, in Conundrum Gulch, is the best property there and could ship a large amount of high-grade mineral.

The Minneapolis, showing carbonates of copper, gray copper, and lead, has been worked very extensively during the year."

South of Slate Mountain is Castle Gulch. Here is found the property of the Castle Peak Mining and Smelting Company. The property of this company consists of thirteen claims and three mill sites, all patented; also a smelter that with very little labor and expense can be put in running order. The improvements made this last season consist of a boarding-house 16 by 24 feet, and other necessary buildings, shops, &c., at the mouth of each of the two tunnels that are working and will be worked all winter. The Sterling tunnel is being driven on a cross vein to cut the Sterling vein proper, which is generally conceded to be the west extension of the Montezuma. This tunnel is now in about 150 feet, and will have to be driven 100 feet farther to cut the vein. This tunnel will also develop the Sentinel and Cliff lodes, two of the company's claims, and the Stonewall lode, one of the Big Six Mining Company's claims. The Plumas tunnel is run on the Plumas vein, and is now in about 200 feet, the breast of the tunnel disclosing a 12-inch streak of fine galena ore running from 75 to 1,400 ounces per ton. This is the tunnel where the recent rich strike was made. The body of the ore is increasing in width as the tunnel gains depth. There is also another property, which is owned by the president of the Castle Peak Mining Company, which, lying as it does contiguous to the Castle Peak Company's property and showing up very favorable with what little development work has been done, gives promise of coming to the front next season.

The Rainstorm group.—This property is situated on Pearl Mountain, near the head of Castle Creek, and comprises the following claims: The Rainstorm, Tibbetts, May Queen, Jay Gould, and Castle Queen. The development work on the Rainstorm consists of a tunnel and an open cut of 17 feet, from which ore was taken that mill-run at Leadville 42 ounces silver and 12 per cent. copper. The vein is 4 feet wide, with a pay-streak of 8 inches.

The Tibbetts has a vein 27 feet wide, of which assays have given returns from 20 to 780 ounces silver to the ton.

The other claims have only the assessment work done on them. A tunnel is being run to cross-cut these veins at a great depth, which is now in to the distance of 217 feet, and it is confidently expected by the management to cut the vein within the next 21 feet, when this mine will become a permanent shipper. Several large veins have been cut in driving the tunnel, from which some very fine mineral has been taken out.

At Independence nothing is being done. The Farwell Consolidated Mining Company, that at one time was one of the largest gold producers in Colorado, has been closed the entire year.

The production of Pitkin County in 1883 was, approximately: Gold, $2,000; silver, $55,000; total, $57,000, a reduction from the previous year.

## RIO GRANDE COUNTY.

The only mine in the county in regard to which any information has been obtained is the Golconda, located on the summit between More Creek and Crooked River. Some 80 tons of ore have been produced during the year by it, averaging $50 to the ton. The mine contains two veins, running north and south about 30 feet apart, each about 20 inches in width, carrying free gold. I have estimated the production of this county during the year 1883 to have been: Gold, $180,000; silver, $10,000; total $190,000.

## ROUTT COUNTY.

Routt County is more devoted to agricultural pursuits than mining, but some mining has been done each year, principally on the Elk River and its forks, and considerable gold is annually produced. On Poverty

Bar, a claim worked by Judge McIntosh, is said to have taken out some $16,000 during the past year. Carruthers and Hinman, who have a claim at the upper end of Poverty Bar, have done very well during the year. Owing to scarcity of water these claims can only be worked about two months in the spring. Mr. Hutchinson has continued work on the Purdy ground, and Mr. Wood has some rich ground, about 300 acres, on a wash called String Ridge. I have estimated, from the reports furnished by the miners of this section, the production of the county during the calendar year 1883 to have been in gold $40,000.

## SAGUACHE COUNTY.

Saguache County has made but little advancement in mining matters during the year, and the future looks but a shade better than it did a year ago. The high-grade ores are refractory and not in demand by the smelter just now. There is but a comparatively small number of mines producing or being put in shape for future production. In the vicinity of Bonanza, Sedgwick, and Exchequer the veins are broad and carry good pay-streaks, but the absence of lead is the drawback. Although considerable work is being done along the foot hills of the Sangre de Christo range, the mines in the vicinity of Bonanza will, sooner or later, find a demand for their ores and will be the scene of active and extensive operations.

On Little Kerber Creek, near the town of Claytonia, is the Columbia, which has been shipping some ore from a pay-streak 4 feet wide composed of one-half pipe clay. The ore is free milling and runs from $20 to $40 gold per ton and about 16 ounces silver. The other half of this pay-streak is quartz that has milled 2.6 ounces gold and 200 ounces silver per ton. The mine is in good shape for a large production, but just at present no ore is being extracted, because the owners prefer to wait until their own stamp mill (which is now being erected) is finished.

The only extension that has been found to this vein is the Mohawk, which is on the northwest end of the Columbia. The only development on the Mohawk is a shaft 60 feet deep, which shows unmistakably the same character of ore found in the Columbia, and has as large, if not a larger, body of it.

The Mars, near by, is another property that has shipped ore similar to that found in the Columbia and Mohawk. Development only is needed to put the property in shape for extensive operations.

Across the divide in Stowe's Gulch the United States and India are being systematically developed. On the United States is a shaft 160 feet deep from which levels are run at 80 and 160 feet depth, respectively. The 80-foot level is 120 feet long and the 160-foot level 50 feet long.

On the India the shaft is 160 feet deep, with an aggregate of 175 feet of levels at depths of 75 and 150 feet. These veins are about 12 feet wide, carrying sulphide and bromide of silver that average $50 per ton. An amalgamator was recently built to treat the ores from these mines and started running about the close of the present year.

The Albert, in Enterprise Gulch, has been shipping considerable ore during the year which averaged $90 per ton. The vein is 3½ feet wide, the pay-streaks, of which there are two, averaging 8 inches each, the character of which is sulphides and native silver. The only developments consist of a shaft 125 feet deep, with a level at bottom of shaft 20 feet long.

Only assessment work has been done on the R. E. Lee during the year. The only development consists of a shaft 86 feet deep, which discloses a 3-foot vein, carrying a 20-inch pay-streak of good grade mineral.

The Exchequer, near the town of Exchequer, possesses one of the largest ore bodies in this county. It is a true fissure from 25 to 30 feet in width, with a pay-streak of from 2 to 8 feet wide. A great deal of the Exchequer ore is free milling, carrying from 50 to 90 ounces silver per ton. The development consists of an incline about 175 feet long.

The Bonanza mine, north of the Exchequer, is being cleaned out for a continuation of development and exploration. The shaft at a depth of 90 feet showed 7 feet of galena, mixed with quartz. Not having the hanging wall, the owners commenced cross-cutting for it and ran into a streak of galena and gray copper ore of high grade. No shipments were made from this property during the year on account of the ore being of too low a grade.

The Revenue mine was cleaned out and a new plant of machinery erected during the summer, after which some ore was shipped that netted a profit of about $30 per ton.

In the Arkansas the development is the same as a year ago, no work having been done during the year.

The Keystone is developed by a shaft 120 feet deep and 40 feet of levels. The ore is low grade, and therefore the property is not worked.

The Rawley, in Rawley Gulch, is one of the most productive mines in the county. This mine is developed by two adit levels, each being 300 feet long, and one about 80 feet above the other. The upper adit is connected with the surface by a shaft 62 feet deep, and with the lower adit by a winze. The vein is about 12 feet between walls, having two distinct pay-streaks, one being galena, carrying about 30 ounces silver per ton and 45 per cent. lead; the other pay-streak is quite broad, containing a copper-stained quartz and gray copper, averaging 20 ounces silver per ton. The stopes contain at present about 10,000 tons of ore, valued at from $30 to $40 per ton, and the estimated value of ore on dump is $25,000. Shipments are regular from the Rawley, which employs about twenty men.

The Antero, on the divide between Rawley and Squirrel Gulches, is undergoing a course of development. A shaft has been sunk 110 feet deep, and levels run both ways on the vein, which carries a pay-streak about 30 inches wide, the character of mineral being chlorides and iron and copper pyrites, that will average $80 per ton.

In Merrimac Gulch the Little Jennie is being systematically developed, and some ore extracted and shipped. The pay-streak is about 30 inches wide, carrying copper pyrites and gray copper that will average 30 ounces of silver per ton.

The Monitor No. 4, that formerly produced some rich ore, was not worked during the year; as also the Merrimac, Gipsey Queen, and Kearsarge.

The Four Per Cent, at the base of Round Mountain, is being opened by a cross-cut tunnel which is 300 feet long, a shaft 80 feet deep, and a drift on the vein 100 feet long. The ore is a gray copper that averages $140 per ton.

The Little Elva mine, at the head of Bear Gulch, has been shipping some high grade ore. This property is developed by a cross-cut tunnel 171 feet long; from this point an incline is run on the vein 50 feet, and from the end of this a drift 15 feet. Further up on the vein is a shaft 80 feet deep. The width between walls is 5 feet. The mineral streak is from 8 to 15 inches wide. The ore averages two-tenths ounce of gold and 155 ounces of silver per ton.

The John Roberts is developed by a drift 140 feet long and a shaft 30 feet deep. These workings expose a vein 3 feet wide with pay-streak 3 to 13 inches. The ore averages 50 ounces silver and 50 per cent. lead per ton.

The Calumet, in addition to about eight open cuts that average 10 feet deep each, has a shaft 30 feet deep. From these cuts about 6 tons of galena ore, averaging 60 ounces of silver, were extracted. At the opening of the coming season more systematic developments will be begun.

The Manitou group of mines is being extensively developed. A cross-cut tunnel 650 feet long has been run that intersects the Little Manitou vein at a depth of 468 feet from the surface, exposing an 8-foot vein.

On the Big Manitou mine there are about 300 feet in drifts and shafts. A very small amount of ore was shipped during the year, but about 100 tons with a value of $40 per ton is on the dump.

The Orthola is developed by an incline 72 feet long, in driving which about 60 tons of ore were extracted, the character being iron and lead carbonates averaging $35 per ton.

The Superior, on the opposite side of the gulch, is developed by a shaft 140 feet deep, with short levels run at 70 feet and 140 feet depths respectively. The vein is about 5 feet wide, with pay-streak averaging 22 inches. The character of the ore is galena, gray copper, and iron pyrites; it runs from 20 to 60 oz. silver per ton.

The Pacific, near the Superior, possesses three shafts, 40, 25, and 16 feet deep respectively. These workings disclose a vein about 5 feet wide of scattered galena that runs about $20 per ton. A cross-cut tunnel was run 110 feet to cut the vein.

The Lawrence possesses a shaft 110 feet deep, with levels run at a depth of 60 and 95 feet respectively. The 60-foot level is 25 feet long, the 95-foot level 50 feet. The vein is about 6 feet wide. the mineral streak about 24 inches, but of very low grade in silver.

The Empress Josephine mine is probably the largest producer in Saguache County. Machinery was erected during the summer, and the shaft. which is about 250 feet deep, will be sunk to a depth of 500 feet. From the shaft four levels run that aggregate 500 feet. The ore is a very high grade of gray copper and galena. The vein averages 10 feet wide, the pay-streak 25 inches.

The Hortense mine, since it became the property of Joseph Watson, in March last, has been systematically developed and has produced some very rich ore. The pay-streak averages 2 feet and carries mostly gray copper, although occasional pockets of rich tellurium are found. This mine has greatly improved with depth.

The Boss Mammoth mine, near the Empress Josephine, shipped considerable ore during the year. Although not so extensively developed as its neighbor, it has produced ore as rich, yielding gray copper and galena averaging $200 per ton. The vein is about 8 feet wide; the pay-streak averages 26 inches.

The June lode possesses a shaft 50 feet deep and a cross-cut 200 feet long that cuts the vein, where levels are run that aggregate 100 feet. The vein is 6 feet between walls and the pay-streak about 20 inches. The ore is galena and copper-stained quartz. The average value is about $80 per ton.

The following description of the mines of the *Crystal Hill* district has been furnished by James W. Ferguson, of Biedell, Colorado:

"Saguache County has been described before, therefore it is unnecessary to do it again. Carnevo mining camp is located in the southwest corner of the county, 18 miles southwest of Saguache and 22 miles from Del Norte. Some valuable mines have been opened in this camp in the last ten months. The formations are of contact blanket veins of black manganese, which run high in gold and silver.

The Buckhorn is the principal mine in the district, being the only paying one at present. This mine is perhaps one of the finest in the State of Colorado; it has paid for all the development done on it, besides giving a net proceed of $24,000. It is developed by an incline tunnel 150 feet deep, with two drifts at the depth of 100 feet; work is progressing steadily on it, and the company intends putting up a steam hoister and a dryer as soon as possible.

The Montezuma lode has a 14-foot shaft, showing a vein of black manganese 14 inches thick that runs well in gold and silver. Tests have been made on the ore from the surface, and it has been found to run as high as $80.

The Speigle group embraces the Elephant, Pittsburgh, and Leadville lodes. The Elephant is developed by a tunnel 78 feet deep, showing a 4-foot lead of high-grade ore.

The Pittsburgh has a 20-foot shaft, showing a 5-foot lead of black manganese.

The Leadville has a 55-foot shaft, in which no lode has been struck more than 3 inches wide. The manganese in this lead is very rich, but no large beads have yet been discovered.

The Andes and Little Ellis are promising prospects. Work is steadily progressing on these claims, but as yet little development has been done. The Andes shows a 3½-foot lead of manganese that runs $20 in gold and a trace in silver.

Newport lode is one of the finest in the camp, and shows up well for the development done on it. The lead is 9 feet wide, and consists of quartzite and iron carbonates.

The Dandy, on Crystal Hill, exhibits a large body of manganese at the depth of 27 feet, one of the most promising prospects in the district.

The Kesler lode is the finest piece of property around for the amouut of development done on it. Free gold was found from the surface. The mine has a 56-foot shaft on it from which was taken two mill-runs, one at the depth of 53 feet, which gave returns of $37.50, and another at the depth of 56 feet that yielded $55. This property has been lying idle part of the year on account of trouble among the owners, but work will soon be resumed.

The Sweet Bye and Bye is an extension of the Kesler and shows the same ore.

The Last Resort is developed by a 50-foot tunnel; work is going on steadily. The ore shows a foot of manganese.

Paradox group embraces the Pride of the West, Humbolt, Paradox, and Flying Dutchman. Pride of the West is developed by an 18-foot shaft disclosing a fine vein of hard carbonate, which runs from $21 to $1,800 in gold. The Paradox, Humbolt, and Flying Dutchman have only the assessment work done on them.

Ratler lode, in the San Juan Gulch, has a 12-foot shaft; in it there is a well-defined lead of black manganese. The mine is still being worked.

I. H. L. lode, in San Juan Gulch, has a 12-foot cut with 11-foot face exhibiting a bed of black manganese dipping at an angle of 45° to the southeast.

The following is a group of mines: La Plata Verda, Madras, Minnie Lee, Bombay, Buchanan, and Caledonian.

The La Plata Verda has an 18-foot shaft, showing a 4-foot lead with 10-inch pay-streak, which assays $150 in silver and 20 per cent. copper. There are 4 tons of ore on the dump that will mill $100 per ton. One hundred feet from shaft is another lead running parallel with the La Plata Verda, and carrying galena and heavy spar.

The Madras is an extension of the La Plata Verda on the south. This claim has the assessment worked on the lead that crops on the La Plata Verda and shows spar and galena in large amounts.

The Minnie Lee has a shaft 16 feet deep. The body of a 5-foot lead is spar, which carries galena, crystallized lead, manganese, and antimonial silver. At present there are three tons of ore on the dump, averaging $75 per ton.

The Bombay lode shaft, 22 feet deep, has a lead of carbonate of iron and lead.

Buccaneer lode has a shaft 12 feet deep, showing a horizontal layer of black sand 4 inches in thickness, and a vertical lead of sand carbonates 10 inches wide.

Caledonian lode lies parallel with the Buccaneer, and is in formation the same.

The claims mentioned above are situated on Ophir Mountain, in Crystal Hill mining district.

The Oswego, Alpha, and Empire have had the assessment work done on them, and show well-defined leads bearing carbonites of iron and lead.

The Esperanza mine, near the town of Biedell, is being extensively developed. The vein matter is similar to that found in the Bassick mine, in Custer County, it being iron and manganese, gangue and trachyte, bowlders carrying tellurium, and gold. The vein is 40 feet wide, and the ore is found on the hanging and foot walls. The developments consist of a shaft 100 feet deep, a cross-cut 40 feet in length, and a drift on the foot wall 40 feet long. The walls are well defined, and can be easily traced for 2,000 feet. About 50 tons of ore extracted will average 100 ounces of silver and 10 ounces of gold per ton.

Near the town of Creston the most promising properties are the North Andover, Lion Mountain, and Garfield.

The North Andover possesses two tunnels of 700 feet each, three shafts aggregating 125 feet, and three levels of 25 feet each. The pay-streak is from 6 to 24 inches in width, consisting of galena ore running from 50 to 65 per cent. lead, 50 ounces of silver, and a small amount of gold per ton.

The Mountain Lion is developed by an incline tunnel 100 feet long and about 80 feet of drifting. The ore is galena, averaging 50 ounces of silver per ton.

The Garfield lode is opened by a drift 50 feet long, at which point a shaft is sunk 75 feet. The pay-streak, about 2 feet wide in porphyry rock, is an oxide of iron, which is comparatively free milling; also hematite and pyrites of iron. The value of the ore averages $50 per ton in gold."

I have estimated the production of this county for 1883 to have been: Gold, $5,000; silver, $100,000; total, $105,000.

## SAN JUAN COUNTY.

This county, situated in the heart of the San Juan country, is surrounded on all sides by high ranges of mountains, inclosing a high plateau or park, on which Silverton, the chief mining camp in the county, is located. The output of ore was small for the first six months of the year as compared with the latter half. This was caused by the backwardness of the season, the winter continuing until June. Notwithstanding this, numerous discoveries of importance have been made; development has in many instances shown remarkable results, and many properties that a year ago were prospects are now producing mines.

A number of new enterprises of considerable magnitude have been started, tramways have been built, a few plants of machinery have been placed on properties worked by shafts, roads and trails have been built or repaired, and the outlook for the future is certainly brighter and healthier than ever before for this county.

The railroad tariff is heavy on low grade ores, and must still operate to bar some of the best mines in the district until such times as lower rates can be obtained.

The leasing system is gaining favor, and will no doubt tend to increase the production.

In the northern portion of the county, in the Red Mountains, the formation and character is described in the review of this district under Ouray County. The county line passes on the summit of the divide, and for some time there existed considerable doubt regarding which county, Ouray or San Juan, quite a number of these mines were in. Regarding the location, each mine owner was requested to state whether his property was in Ouray or San Juan County, and the production reported is accordingly placed to the credit of the county in which the same is located.

On Sultan Mountain, near Silverton, is the North Star No. 1 mine, the property of the Sultan Mountain Mining Company. This mine has been worked for several years, the greater portion of the proceeds up to within a short time ago having been used to develop farther and put it in shape to operate on a large scale.

There are now four drifts. The first is in 175 feet; No. 2 is in 544; No. 3 is in 727; No. 4, 370. The distance between Nos. 1 and 2 is 70 feet; between 2 and 3 is 35 feet; between 3 and 4, 110 feet.

The body of mineral will average 10 feet in width, and the average value is about $120 per ton. The character of ore is galena carrying gold and silver.

The North Star No. 2 mine is owned by the Silverton Mining Company, and worked under lease by Messrs. Wilson & Johnson, who have taken out 550 tons of ore that run 100 ounces silver, one-half ounce gold, and 40 per cent. lead per ton. About 100 tons of the same character of ore are on the dump. During the fall and winter 1,000 feet of drifts have been run, and everything put in shape for a heavy production next season. The character of the ore is galena, carrying gold and silver. The ore body is from 6 to 8 feet wide. The aggregate number of feet in drifts, winzes, shafts, &c., amount to about 1,500 feet.

Belcher mine is situated at timber line on the north side of Sultan Mountain, and has long been known as a valuable property. Since coming into the hands of the present owners, about one year ago, an aggregate of 1,400 feet of levels and shafts have been run, and over 1,700 tons of ore extracted that has yielded an average of 38 ounces silver and

40 per cent. lead. About 50 tons of ore now on the dump will average same as above. The mine is opened by three levels on the vein, but only the No. 2, or lower level, is being worked this winter. This level has been extended some 200 feet beyond the main ore body, and has for 100 feet been in a permanent streak, averaging 5 inches in width that sample assays show to run 65 ounces. Three hundred feet lower, vertically, a cross-cut, now in 500 feet, is being run to cut the vein; some 200 feet yet remains to run before cutting the vein. Three shifts of three men each are driving this cross-cut. When the vein is reached drifting and raising to connect with the upper workings will be pushed to the fullest extent.

The Empire mine, the extreme extension of the North Star, is one of a group of five mines belonging to the Mellville Mining and Reduction Company, all being on the eastern slope of Sultan Mountain. The mine has been idle for several years, principally on account of there being no means of concentrating that part of the ore produced from the mine, and which constitutes the larger portion of the pay-streak, namely, the iron pyrites, of which the vein shows an average width throughout the workings of about 22 inches, having a gross value, as shown by various mill runs, of six-tenths of an ounce of gold, 8 to 12 ounces of silver, and 36 per cent. of iron. The streak of gray copper from which the only shipments were made varies in width from 8 to 18 inches, the average value being one-tenth of an ounce of gold, 75 to 80 ounces of silver, and 10 per cent. of copper per ton. The other mines of this group possess the same character of ore as the Empire, but showing a larger amount of iron and less gray copper so far as developed. This company owns a fine mill at the foot of Sultan Mountain that has been idle for some years, but the indications are that early in the spring this will start up, or at least the concentrator.

The developments of this group are mostly on the Empire, where a cross-cut tunnel 225 feet long intersects the bottom of a shaft 110 feet deep. Levels are run each side of the shaft at depths of 50 and 110 feet. The 50-feet levels are 30 and 45 feet long, respectively, and those at 110 feet are 102 and 20 feet.

The Ajax-Victoria group is being developed by tunnels, and the property is now in a condition to produce. A tunnel, known as the Victoria tunnel, was driven 504 feet through granite when the Victoria lode was cut, showing a vein 5 feet between walls—a pay-streak of 2 feet is composed of iron and copper pyrites, galena, and gray copper. The average of the entire vein-filling will run 60 ounces silver, four-tenths ounce gold, and 4 per cent. copper per ton. The Ajax tunnel is 340 feet long, at which length it intersects the Ajax lode, whose showing is equal to that of the Victoria. This tunnel will be extended 175 feet farther, when the Victoria lode will be cut about 125 feet deeper than it is intersected by the Victoria tunnel.

The Cleveland, on Sultan, is now being worked under lease. The mine has a large amount of development, or rather a large amount of work has been done looking to the future development of the property. A cross-cut tunnel has been run several hundred feet to cut the vein, but has not yet reached it. The mine has shipped 15 tons of ore to Denver that gave returns of 150 ounces silver and 5 per cent. copper. About 10 tons on the dump will average the same as above.

On Hazelton Mountain the Gray Eagle is developed by an aggregate of 1,000 feet of drifts and 200 feet of winzes. The vein is about 4 feet wide, carrying galena and gray copper that will average 70 ounces silver per ton and 55 per cent. lead. Water has caused much trouble, but machinery is being placed to handle this.

On Round Mountain, the Round Mountain claim has been extensively worked during the year, and considerable ore shipped. The development consists of a drift 50 feet deep on the vein, from which about 90 tons of ore was extracted. A new drift, lower down, is now being run, which will probably be the main working level, as the upper one has very nearly reached the end line.

One of the biggest veins and best showings of mineral in San Juan is to be found in the Silver Lake, on Round Mountain. Considerable work has been done on the surface, along the vein, to show the course. Fifty-five feet of a drift which has been run on the eastern end of the claim shows from 3 to 6 feet of ore encountered. In the breast 6 feet is shown, and not nearly the size of the vein is opened by the drift. From the working there was shipped to Sweet's sampling works 72 tons of ore that contained 2,016 ounces of silver and 7 ounces of gold, and that averaged 55 per cent. lead. Ten tons of ore are on the dump, sacked, ready for shipment.

On the Queen of Boulder no shipments were made, but the dump is covered with ore that will average $50 per ton. The character of ore is chlorides, sulphurets, and copper pyrites. The developments consist of two drifts on the vein, one being 200 feet the other 115 feet long.

On Green Mountain is the property of the Green Mountain Mining Company, viz, the Green Mountain and Green Mountain Extension Mines. The ore is galena, averaging 50 ounces silver and 50 per cent. lead per ton. The vein is about 8 feet wide, with a pay-streak of 3 feet of solid mineral. The aggregate number of feet in levels is about 500 and in shafts about 200 feet. The production of this mine during 1883 was about 300 tons of ore, which averaged 38 ounces of silver and 45 per cent. lead to the ton.

The Pride of the West is reported to be looking well and shipping some ore. The property is developed by a cross-cut tunnel, which is now 700 feet in length. The property of the Kansas City and San Juan Tunnel Company has not been worked during the year; the mines are adjoining those of the Green Mountain, and from surface indications the width of vein and character of ores are the same. The property consists of twelve claims, and from all appearances would with proper development be valuable.

On the summit of Solomon Mountain is the French Boys Silver Mining Company. The company own six claims and have capital to thoroughly develop the property. The ore is a gray copper and galena in a 10 to 20 inch pay-streak. The mine has a large amount of development, considering the length of time that the property has been in the hands of the present owners. The mine is opened by a cross-cut tunnel that taps the vein at a depth of between two and three hundred feet. From this tunnel drifts have been driven either way about 125 feet. From this level a raise through to the level above, distant 140 feet, has been made. On this level about 250 feet of drifting has been done. A shaft has been sunk from the bottom of the lower level, showing well. It is the expectation to run a cross-cut tunnel to tap the vein 300 feet deeper and some 800 or 1,000 feet west of the present workings. A force of twenty men was employed from June to November in doing the above work.

The Lackawanna group of mines, on Kendal Mountain, is developing considerable ground for next season's stoping. Two tunnels cut the property. Tunnel No. 1 is in 340 feet and tunnel No. 2 in 350 feet;

from heading of No. 2 it is 250 feet to surface. Stoping will be commenced in April. Forty tons have been sampled, and gave an average of 50 ounces silver and 20 per cent. lead. About 15 tons remain on the dump, and is estimated to run same as above. The property is favorably situated, being only a half mile from town. A tramway could easily be constructed from the mine to the railroad.

The North Star, on Solomon, is one of the big mines of the camp. This property produced quite a large amount of ore prior to the present season of an excellent grade. The past summer there have been taken out and shipped 550 tons of ore, that run 100 ounces silver, one-half ounce gold, and 40 per cent. lead. About 100 tons of the same character of ore are on the dump.

The Scranton City, on the same mountain, is showing well. An assessment work shows a vein 4 feet between walls. A cross-cut in about 75 feet will tap the vein at a depth of 100 feet. Five tons of ore milled yielded 90 ounces silver per ton, and 40 per cent. lead. The ore is principally galena with some copper pyrites.

The Emerald mine, on Anvil, has considerable development, consisting of a cross-cut tunnel tapping the vein; also about 120 feet of drifts and shafts. The mine has produced considerable ore from the date of its discovery. The last year some 30 tons were shipped to Sweet's sampling works that averaged 75 ounces silver and 20 per cent. lead.

On Boulder Mountain, 4 miles from Silverton, is the Uncle Sam, owned by a company of that name. Since October a large force has been employed to push development work. Two cross-cut tunnels have been started; the upper one is 88 feet long, exposing some three or four promising veins, on which drifting has been done and some ore extracted. The lower tunnel is but 50 feet, a little more than through slide rock. At the surface the Uncle Sam vein varies from 50 to 100 feet in width, and contains numerous streaks of ore and quartz. The ore is galena and gray copper running from 75 to 175 ounces silver per ton. Drifts are being run and the property put in shape.

On Red Mountain, near Red Mountain City, but in San Juan County, are the Congress, Senate, Salem, Saint Paul, and others, and near Chattanooga numerous good prospects.

The Congress was located during the fall of 1881. Being late in the season nothing but the assessment work was done in 1881, but early the next spring the owners resumed work and sunk a 50-foot shaft all the way through solid mineral. In the summer of 1882 the Congress was bonded for $15,000, and it was sold to the present owners six days afterwards for $21,000. The new purchasers at once organized a company. More than 100 tons of ore were shipped before the season was over, and fully as much more remains on the dump at the present time, making in all nearly 200 tons of solid mineral which has been taken out of the Congress shaft, which is now only 90 feet deep. The only drifting that has ever been done was at the 50-foot level, directly after the purchase, when they drifted 18 feet, endeavoring to find the extent of the ore body, but nothing save solid mineral was encountered. The 200 tons of ore shipped from the Congress last fall netted, after paying for mining, shipping, and smelting, $53 per ton. The cross-cut is 275 feet in length and cuts the vein, intersecting the bottom of the shaft, at about 85 feet depth, and runs through 15 feet of solid mineral before reaching the shaft. The ore is copper pyrites carrying gold and silver, and like the ore of the Yankee Girl it needs no sorting—is shipped just as it comes from the mine. Average ounces of gold per ton, 1½; silver, 20; and copper 30 per cent. For the year the average daily output has been about 8 tons per day. A new road has been built to the mine, ore sheds and engine-house completed, and new machinery placed.

Adjoining the Congress is the Senate. The shaft is situated about 60 feet from the line of the Congress, and no doubt will encounter the same ore body now yielding so heavily in that mine. The shaft is 75 feet deep, at which point cross-cuts and drifts are being run.

The Saint Paul, also adjoining the Congress, is being developed by a shaft 45 feet deep, the character of mineral improving with every foot of depth. The ore is copper pyrites and galena of rather low grade.

The Salem mine joins the Congress on the north. Considerable work has been done on this property both this season and last. The vein is wide and the ore scattered. The ore runs high in copper, and occasional pockets of high grade in gold and silver are found.

Near Chattanooga are the Jenny Lind, Windsor, Bertha and Ida, Big Four, Bonanza Boy, Dipper, Genneseo, Humboldt, Providence, Silver Cup, Independence, Silver Ledge, Little Maud, and probably twenty others of as good indications. On all the claims named except the last three, but a very small amount of work has been done, some possessing nothing but a 10-foot hole, others with a shaft or drift 50 feet, but in each case sufficient has been done to expose an ore body and encourage work during the coming season.

On the Independence is an open cut 50 feet, showing a 3-foot body of galena in the breast, carrying an 8-inch streak of gray copper ore. The average value of vein filling is about 66 ounces silver and 30 per cent. lead. Preparations are now being made to push development and ship the ore in the stope and on the dump, which amounts to about 100 tons.

The Silver Ledge is a property of great promise. A drift 25 feet in the vein, and a shaft 25 feet in depth constitute the principal workings, but several open cuts demonstrate that the ore body is of great width. The ore is low grade, but the great quantity fully compensates for this as it is of a nature to be easily concentrated, as there is little besides galena, quartz, and talc in the vein, which is about 12 feet wide.

The Little Maud is at present the most promising property in this immediate neighborhood. The lode was discovered in May, 1883, is a full claim, and has become celebrated on account of the caves occurring in the mine.

*Eureka district* will in a few years become as prominent as the Red Mountain district. Very little ore has been shipped from this part of San Juan County, because the mines as a general rule are above timber line and somewhat inaccessible, and the ore has to be packed on burros quite a distance, then by wagons to Silverton for shipment to outside smelters. Concentrating works are now being erected, after which Eureka will come forward and rank among the best districts in the San Juan.

On the east side of the Animas River the Tom Moore Mining Company own a group of five well-developed claims. During the year nothing beyond 33 feet of tunneling was done. The ore is low grade, but there is plenty of that. With a concentrator this property would be a producer, otherwise the ore is too low grade to ship.

The Ben Franklin mine, which during the present season has produced such an excitement in the San Juan, is situated on the North Ford of Eureka Gulch, and two miles from the town of Eureka. This is a large true fissure vein, and at one point has an uncovered width of mineral of 150 feet. The developments consist of two tunnels, one 80 feet, the other 20 feet. In driving the 80-foot tunnel about 300 tons of ore were extracted that carried copper pyrites, gray copper, and native silver, which is estimated will average $36 per ton. There are three caves on the claim, one carrying gray copper, assaying 591 to 680 ounces silver per ton; another cave carrying native and brittle silver and gold, assaying 1,660 ounces silver and 20 ounces gold per ton. These caves are only prospected, have not been worked, and remain in about the same condition as when first discovered. About 20 pounds of silver in chunks and nuggets have been taken out of the silver cave. These two caves are directly opposite each other and 60 feet apart, and are separated by a cascade or waterfall, which cuts the claim in twain about the center. The 80-foot tunnel is now being driven steadily ahead to cut under what is known as Gray Copper Cave, which is 100 feet ahead of the breast of tunnel. When this is reached a drift will be run at right angles across to and under the "silver" cave. The last and smallest cave is near the edge of the cascade or waterfall 100 feet below the silver cave; carries iron in cubes with now and then specks of gray copper. A large force are at work.

The average width of the mineral body, as tested for a distance of 900 feet, is 50 feet; that is, the ore body exposed may fairly be called 900 feet long and 50 feet wide. A main shaft has been commenced where the ore body is 150 feet wide, and will be sunk, if the present plans are carried out, 300 feet deep, with levels at intervals of 100 feet, running both directions from the shaft. Tons of mineral have already been encountered, which assay over $1,000 per ton, with blocks of Bismuth silver running as high as $2,300 per ton. Concentrating mineral forms the surface body of the lode, and continues in a solid body for a depth of about 25 feet, when it changes into high grade mineral. By the Franklin Company consenting to pay one-half of the expense of constructing from Eureka to the mine, a distance of 2 miles, the county finished in October a good wagon road to the dump of the Franklin, and the supplies were hauled over it, substantial winter houses constructed, and the mine will be worked all winter. The Franklin, as also the Hidden Hand and Dover, two extensions, and the Clay and Webster, two side lodes, are all patented. They are now making preparations and getting estimates for tramway and milling machinery, and intend to work their own ores.

The Webster mine in Dry Gulch has a shaft 50 feet in depth, and at the bottom a cave was broken into extending 50 feet deeper, exposing a large body of ore. From the shaft 25 tons were sampled at Sweet's and Comstock's sampling works that yielded 25 ounces silver, one-half ounce gold, and 16 per cent. copper. About 10 tons on the dump is valued at $60 per ton. This property was discovered last summer and created quite an excitement along with the Little Prince and others in the vicinity, but owing to lateness of the season and other causes, failed to fit up for work during the winter.

The Sunnyside, near the Franklin, has been working continuously, filling a contract with the Pueblo smelters for 4,000 tons of ore. The only drawback to this ore is the large per cent. of zinc it contains, but for that it would be one of the most desirable dry ores found in the State. The drift on the vein is 487 feet, from which several cross-cuts were run, the total of which aggregate 100 feet. The mineral streak is from 16 to 24 feet wide, and the pay streak from 4 to 7 feet. The drift for 130 feet in length and 12 feet wide by 7 feet high is solid mineral. About half-way up the claim is a cross-cut 28 feet long, that cuts through solid mineral the entire distance. A shaft 29 feet was sunk which shows the same kind of mineral. The ore carries considerable gold and only about 5 to 10 per cent. lead.

The No Name mine is being worked extensively. A force of twelve men have been working since October, and a cross-cut is being run to intersect the lode, which at present is 145 feet. Two drifts, one 14, the other 30 feet, disclose a good body of galena and gray copper ore.

The Sunnyside Extension have employed about five men constantly at work on development. The vein is about the same width as the Sunnyside, averaging probably 50 feet, but widening in places to 135 feet. It is difficult to speculate too heavily upon the probable continuity of the gold streak, as it is decomposed and broken up—development must prove the character of the lode. The walls have not been thoroughly defined on account of the width of the vein. From the cross-cut tunnel of 277 feet, two tunnels are run on the vein. One is in 150 feet and on the hanging wall. It shows considerable galena. The other tunnel is 35 feet from the first, but still on the vein and in 35 feet. It shows gray copper and galena. Mill-runs from ore in this tunnel gave 2 ounces gold and 20 ounces silver per ton. Above this working a tunnel of 50 feet shows decomposed ore which runs from 6 to 12½ ounces gold per ton.

West of this point, but on Cement Creek, near the old town of Gladstone, is the property of the Southern Colorado Bismuth and Silver Mining and Smelting Company. In the Sampson No. 1 and the Sampson No. 2 a rich body of ore was struck. The workings consist of two levels on the Sampson No. 2, on which the main development work is being done. The Sampson No. 1 is the claim farthest northeast, and has comparatively little work done thereon. The Sampson No. 2 has two levels ; the No. 1 or upper consists of a drift of 190 feet along the vein. From this drift, at a point some 70 feet from the heading, a cross-cut about 60 feet in length has been driven to reach the hanging wall, but has failed to reach it. At a point some 15 feet back a vein of quartz was cut through and drifted to the southwest about 20 feet, disclosing a fine body of decomposed sulphuret ore that is said to run well in silver; also contains the same character of quartz, in which is found the gold. This drift has been pushed northeast and intersects the main level at a point a few feet from the present heading and apparently following on a strong body of quartz. The shaft is sunk on this drift at the point of the crossing of the cross-cut before mentioned, and is now 20 feet in depth, the last 11 feet having been sunk through the rich ore (free gold); also showing two streaks of the black sulpuret ore that seems to encase the rich gold streak. It is the intention to continue this shaft on down 130 feet to intersect No. 2 level, but as soon as 30 feet shall be gained drifts will be started both ways and stoping commenced.

Lower down the mountain on the course of the vein a cross-cut, No. 2, 70 feet in length, has been run, and the same general character of vein-matter encountered. A drift from this cross-cut is being run to intersect the shaft from level No. 1. Arrangements are being made and grading done for the terminus of the tramway and boarding-house on this level. The quartz is estimated to run about $1,000 per ton, and the sulphurets about $250 per ton. These sulphurets lie on either side of the gold quartz in seams of from 8 to 12 inches wide.

*Animas Forks district* includes the mines tributary to Mineral Point.

The Mastodon mine joins the Sunnyside Extension on top of the divide. About the same croppings exist here as on the Sunnyside Extension, and probably with development will prove equally as good.

The ore at present is low-grade galena mixed with gray copper. The vein is however not so wide as the Sunnyside or its extension, but will average 35 feet. A company in Cleveland, Ohio, own this property, and will, so it is reported, erect concentrating works.

The Little Dora, in Grouse Gulch, is developed by three tunnels and one shaft. One cross-cut tunnel 210 feet long cuts the vein at a depth of 250 feet; one level on the vein from this tunnel is 145 feet long. Another tunnel 65 feet long cuts the vein at an acute angle 60 feet deep. A shaft 114 feet connects this tunnel with the level below. About 1,200 feet to the southwest is another tunnel 65 feet on the vein, which shows from 2 to 3 feet of mineral that will average 30 ounces silver and 40 per cent. lead per ton. In this mineral is a streak of bismuth from 2 to 4 inches wide, which yields 1,128 ounces silver, 3 ounces gold per ton. The vein between walls is from 10 to 18 feet wide, the gangue rock being chalk-spar. About 400 tons on dump will be shipped in the spring.

The Belle of the Animas is located above the Lily lode, on Jones Mountain. It is not a well-defined vein, but seems to be a chimney or blow-out, which shows a large body of high-grade chloride of silver with a good per cent. of grey copper. The claim is developed by a shaft 15 feet deep, and a tunnel 100 feet long, which is in mineral the entire distance. Several tons of ore have been shipped from this mine which averaged over $100 to the ton.

On Treasury Mountain the Inter-Ocean Mining Company own the Scotia mine. The vein is a strong quartz ledge, varying in width from 10 to 40 feet. It is developed by a cross-cut tunnel 80 feet in length which cuts the vein 95 feet below the surface. At the end of this tunnel is a short drift connecting with the main shaft which is 100 feet. At this depth a level is run 100 feet disclosing a good body of sulphurets, the average value of which is from $35 to $90 per ton. The mineral streak is from 2 to 6 feet wide. About 2,000 tons of ore are on the dump waiting to be concentrated The present value is $25 per ton.

The Golden Fleece crosses the Scotia. A shaft 93 feet has been sunk on the vein, which is from 12 to 30 inches in width. The character of the ore is sulphurets. Occasional pockets of rich gold-bearing quartz are found.

In Poughkeepsie Gulch is the Bonanza mine, owned by the Kalamazoo Bonanza Mining Company. This mine has been continuously worked and a large amount of ore shipped. It has been paying its way and only development work prosecuted. The ore is a gray copper and brittle silver, decidedly different from anything found in this country. The entire vein carries a heavy spar scattered through the vein with equal quantity of the ore, and is of itself considered very rich. The shaft, which has been sunk at the edge of Lake Como, shows a solid body of mineral, all of which is ready for shipment when taken from the mine. The total number of feet of development is about 700. Two shafts aggregate 300 feet, the remainder being in drifts. This property is now in good condition for a large output.

The Lout lode, together with the Atlantic, are being systematically developed. About 100 tons of ore were shipped, the result of development work only.

The Silver Monarch is being worked under a lease, through a cross-cut tunnel 156 feet in length, which cuts a 12-foot vein 115 feet from the surface. A drift of 50 feet is run on the vein. The average pay streak is 15 inches, carrying antimonial silver, gray copper, brittle silver. About 20 tons of ore is sacked waiting the opening of the roads to ship.

On Mineral Mountain the Mineral Mount Mining Company are working continuously on the Red Cloud, but with what results I am unable to state.

The Evans, on the south side of Mineral Mountain, has been shipping some ore extracted in running a tunnel. The only developments consist of four open cuts. A tunnel recently started has reached 20 feet in length.

At Mineral Point work is being pushed night and day on the San Juan Chief. This is a splendid property, and shows 4 feet of high grade copper ore, which mill-runs, from a test of seven car-loads, about 80 ounces silver per ton.

The Maid of the Mist has been cleaned out, and will probably figure as a producer once more.

The British Queen has produced some ore which has paid all expenses besides a good profit. Of the workings of this property I can obtain no information.

The Niagara Consolidated Mining and Milling Company's mines are situated near Eureka. The company owns the Cuba, American, McAlpine, McKinnie, Alta, Money Musk, Tyrol, Central Cross, Cleveland, Cleveland Extension, Boomerang, Tabor, Pride of San Juan, and Junction lodes. Returns have been made from small lots. The Cuba giving returns of 60 ounces silver, ½ ounce gold, and from 10 to 50 per cent. lead; the Boomerang from 11 to 180 ounces silver and from ½ to 3 ounces gold per ton, with a small percentage of copper; the McKinnie from 75 to 178 ounces silver and ½ to 2½ ounces gold. The development consists of 1,200 feet of drifts on the veins. Some 220 tons, estimated, is on the dumps and is valued at $2,300. The mines are said to contain a large amount of ore of rather low grade. The property is under the management of Prof. Theodore B. Comstock.

The Anchor is a valuable prospect discovered in Minnesota Gulch. A tunnel or drift of 50 feet in length has been run on the vein and an attempt made to sink a shaft at the end of the drift; a depth of only 4 feet was gained in the shaft, showing 20 inches of ore. Eleven tons were milled at Silverton and Durango that yielded 54 ounces silver and 11 per cent. lead per ton.

The La Plata Miner publishes the following résumé of the year's output of San Juan County:

"While it is impossible to give the entire output in tons, and its actual value in dollars, yet we have been able to get the accurate results of over 5,955 tons of ore, which we present; and from this we assume that portion of the ore that was shipped without sampling to have been of equally good grade. This will be the more apparent when it is known that by far the larger portion of the unsampled ore was from the Yankee Girl. The total output as shown by the Denver and Rio Grande shipping books is as follows for each month:

| | Tons. |
|---|---|
| January | 760 |
| February | 480 |
| March | 500 |
| April | 510 |
| May | 380 |
| June | 700 |
| July | 1,440 |
| August | 2,130 |
| September | 1,780 |
| October | 1,770 |
| November | 1,240 |
| December | 550 |
| Total | 12,230 |

"In addition to this there were shipped during the same time 2,110 tons of iron ore to the Durango smelter. Of this amount 5,955 tons were sampled in Silverton, and from which we have the returns. We find that the above amount of ore contained 1,119 ounces of gold, 255,394 ounces of silver, 591,362 pounds of copper, and 3,166,860 pounds of lead. This, at the market value, is, in round numbers, worth $496,643, and gives an average of $83.45 per ton. Estimating, then, the total output of 12,230 tons by the value of the 5,955 tons sampled, we find that the total production of San Juan County has been $1,020,593; a marked and satisfactory increase over last year.

"Of the ores sampled two classes would seem to cover it all—copper and lead. The average percentage of copper in the ores sampled and paid for as copper ore was from 15 to 20 per cent., while the great bulk of the ore has been lead ore, and has averaged fully 30 per cent. of that metal."

It will be noticed that this statement includes a large amount shipped from Silverton which was the production of the Yankee Girl. It probably also includes the shipments of the National Belle. Both of these mines are large producers, but neither is situated in San Juan, but in Ouray.

The Mining Record gives the output of San Juan for the same year as follows:

"Since January 1, 1883, there have been shipped from Silverton over the Denver and Rio Grande Railroad over 15,000 tons of ore. Most of this ore has been high grade, running over 100 ounces in silver, but we have placed it at an exceedingly low average—90 ounces—and find that its value is over $1,300,000—a larger production than for year 1882 by very nearly $1,000,000—which is a splendid showing for that length of time. Following is a list of the principal mines that have produced the greater part of the above amount:

| Mine. | Tons. | Value. |
|---|---|---|
| Hudson | 150 | ............ |
| Bonanza, between | 150 and 200 | ............ |
| North Star on Sultan | 2,500 | $200,000 |
| Belcher on Sultan | 1,700 | 85,000 |
| Silverton on Sultan | 500 | 40,900 |
| Aspen on Hazelton | 1,500 | 75,000 |
| Gray Eagle on Hazelton | 300 | 24,000 |
| Green Mountain, Cunningham Gulch | 500 | 25,000 |
| North Star on King Solomon | 550 | 60,000 |
| Congress | 2,500 | 200,000 |
| Total | ............ | 709,900 |

"The Saxon, Alaska, Daniel Webster, Salem, Mineral King and Queen, Uncle Sam, No Name, Ben Franklin, Sunnyside Extension, Grand Exchange, Silver Ledge, Molus, and Columbia have shipped from 10 to 150 tons each.

"There are several others that have produced from 10 to 75 tons, swelling the total product to very near two millions.

"The smelting works have been kept busy the past summer. The following is the number of tons shipped: Stoiber Brothers sampled and bought 3,171; sampled and shipped 793; unsampled and shipped, 927; total, 4,891. E. T. Sweet has crushed, sampled, and shipped 3,760 tons, and T. B. Comstock has crushed, sampled, and shipped 2,500 tons and concentrated 800 tons. Messrs. Stoiber, of Silverton, are reported to have sampled and shipped 2,089½ tons of ore that contained 207 ounces gold, 97,011 ounces silver, 85,212 pounds of copper, and 977,899 pounds of lead. This ore, computed on the market rates of value of its contents, averages $75 in round numbers per ton, or a total of $157,000. In addition, they have shipped a large amount of ore for parties without sampling. It will be remembered that these sampling works were not opened until quite late in the season."

I have estimated the production of this county for 1883 to have been: gold, $35,000; silver, $350,000; total, $385,000. This is a very large increase over the prior year, and shows that there has been considerable activity in mining industries in the county during the year.

## SAN MIGUEL COUNTY.

San Miguel County was created by the legislature of this State during its last session, it having been a portion of Ouray County. Its location is west of San Juan and Ouray Counties, extending to the boundary that separates Colorado from Utah. Montrose County is north and San Juan and Dolores Counties south of San Miguel. Development is in a primitive state, and the indications for the future are bright. From almost every stream and brook gold can be washed and from 5 to 500 colors obtained. It is flour-gold, but that, under the action of improved machinery, will prove no drawback.

In Marshall Basin are veins that are miles long, many of which produce from grass roots.

William Weston, an authority on the San Juan region, says:

"I do not hesitate to say that I believe these ore-bodies are proving themselves to be, for richness and permanency, the most extraordinary vertical fissure gold and silver-bearing veins yet discovered in the State of Colorado, and the character of the mill-runs taken out and sold while doing the dead work will, I think, support my opinion."

Only a few miles from Marshall Basin, near the town of Pandora, the veins carry free gold equal to anything in this State. Still farther to the south, in the vicinity of Telluride, Ophir, and Ames the veins found have pay streaks from 2 to 10 feet wide, the majority of which carry high-grade mineral. Probably no portion of Colorado is better adapted for economical mining than is this portion of the San Juan region, and probably no portion possesses less development. The mountains are so formed that the veins can be worked by cross cut tunnels or drifts, and thereby save the heavy expense attending machinery; but for some reason or other a comparatively small amount of development work is done. This is partly accounted for by heavy charges attending transportation to market.

The county is divided into three mining districts: Lower San Miguel, Upper San Miguel, and Iron Springs districts.

In *Lower San Miguel district* placer mines are the chief source of production, but owing to the scarcity of water these have been worked but little during the past year.

*Upper San Miguel* includes Marshall Basin, Pandora, and the mines tributary to Telluride.

*Iron Springs district* embraces those mines in the vicinity of Ophir and Ames.

In Upper San Miguel district, immediately over the crest of the divide that separates Ouray and San Miguel Counties, on the western slope of Virginius Pass, is Marshall Basin, and here is located the celebrated vein on which three adjoining claims, the Mendota, Sheridan, and Smuggler have attained a just notoriety. This vein, which is generally known as the Smuggler vein, is an undoubted true fissure, from 6 to 12 feet wide, and outcrops boldly on the surface for a distance of 2½ miles. It trends south 18 degrees east, and dips to the west. Beginning at the Mendota, which is just over the divide from the Virginius, the claims on the vein going in a southerly direction are as follows: Mendota, Sheridan, Smuggler, Union, Cleveland, Bullion, Hidden Treasure, Ajax, and five others, the names of which I do not know.

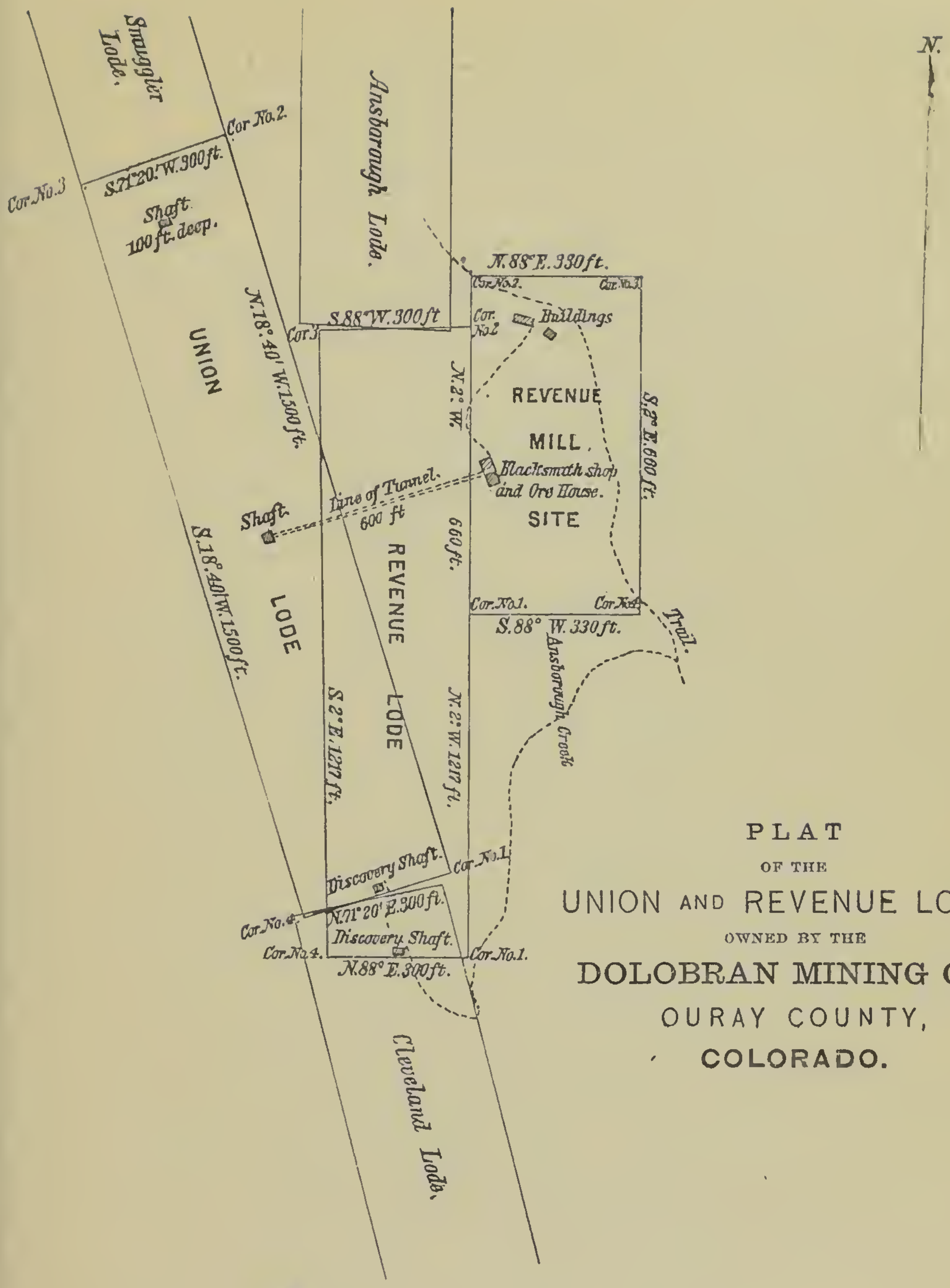
The Mendota is a full claim 1,500 by 300 feet, the width between walls averaging 7 feet, and showing a pay streak that averages 2 feet. The work done on this lode consists of a shaft 165 feet deep. At the depth of 50 feet is a level 100 feet long, and at the depth of 100 feet is another level 140 feet long. The only stoping done consists of about 80 cubic feet in the 50-foot level, from which was taken the ore that has paid all the expenses incurred in developing, besides leaving a good capital for future use. The ore is mostly a dry ore, carrying brittle and ruby silver and free gold.

The Sheridan is developed by three levels aggregating 593 feet, and one winze 70 feet, connecting the first and second levels. Only one-half of the ground opened up has been stoped out. Up to date each fathom of ground has yielded two tons of shipping ore. No ore running below $100 per ton is shipped, but is left on the dump for future disposition. The average width of vein is about the same as in the Mendota and the average width of pay streak about 2 feet. The entire pay streak will average, $100 per ton, but in this pay streak is a streak of brittle silver from 3 to 6 inches that will mill $800 per ton. The Sheridan is well situated for development by drifts, as the drift northward along the course of the vein from the lower end of the claim gains a depth at the upper end of 560 feet.

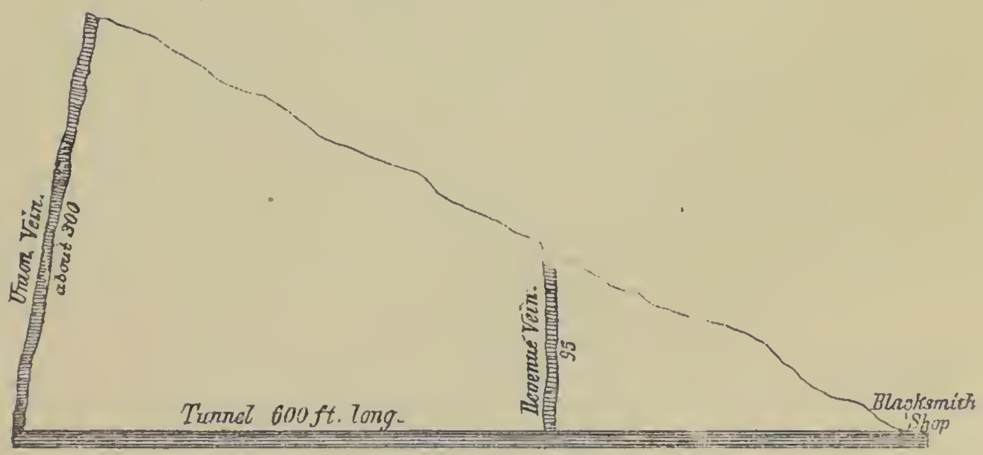
The Smuggler, the adjoining southerly claim, is but 1,056 feet in length The development work consists of a cross-cut tunnel 200 feet in length, intersecting the vein at a depth of about 100 feet below the surface; a winze from the end of this cross-cut to the surface; a drift north from the end of the cross-cut about 420 feet. On this drift, 220 feet from the cross-cut, is a winze to surface, 115 feet, and south from the end of cross-cut a drift 210 feet. All these workings are in ore, the dimensions of each and all being 5 by 7 feet. The mineral streak averages here from 2 to 3 feet, but the ore that is shipped comes from a 6-inch streak; the remainder lies on the dump for concentration. The character of the ore is native brittle and ruby silver, associated with iron and copper pyrites, with a small per cent. of galena. The gangue is quartz and silicate of manganese.

The Union and the adjoining claim, the Revenue, are owned by the Dolobran Mining Company. The width of vein, pay streak, and character of ore is about the same as that in the Smuggler. The recent disclosures made by the tunnel at a depth of 300 feet clearly prove the ore has improved with depth. This tunnel, which is 600 feet long, cuts the Revenue vein at a depth of 95 feet, and the Union vein at a depth of 300 feet. On the last-named claim levels were run, winzes made to connect with a level above, and explorations that aggregate about 250 feet. In addition to these workings a shaft 100 feet deep was sunk near the Smuggler mine line, from which a level 90 feet was run. This company owns, in addition to the two claims mentioned, the Pioneer lode, on which about 100 feet of development work has been done; also a mill-site, as shown in the accompanying plat.

On the Cleveland, Bullion, and Hidden Treasure but a small amount of work has been done and but a very small amount produced. But on



# PLAT
OF THE
# UNION AND REVENUE LODES,
OWNED BY THE
**DOLOBRAN MINING CO.,**
OURAY COUNTY,
**COLORADO.**



SECTION OF TUNNEL
AND
PROFILE OF MOUNTAIN.

the opposite side of the creek the Ajax and the four claims, extensions on the same vein, are beng put in good condition. The property is opened by a tunnel over 600 feet in length, and possesses five different levels. The mineral streak throughout averages 2 feet; the ore is worth about $100 per ton, the greatest value being in gold.

Adjoining the Hidden Treasure and Bullion, and running into the Cleveland, is the Cimarron mine, one of the very rare mines which have more than paid for their own development, and at a time when Marshall Basin was comparatively inaccessible. This claim is 1,500 feet in length by 300 in width. The vein, which is some 8 feet between walls, possesses a pay streak of from 20 to 30 inches, carrying free gold in leaf and wire; also a streak of galena and gray copper, very rich in silver, the value of the ore averaging $300 per. ton. The mine is developed by two drifts, and a cross cut is now being run. This cross-cut will be some 400 feet long; the present length is 200 feet. The two drifts aggregate 600 feet, and but a comparatively small amount of stoping has been done, yet the mine has been one of the largest producers in the San Juan region. The southerly extensions of the Cimarron are the Bradley, Pioneer, Columbus, Erin's Hope, and Pay Rock, none of which are yet producing bullion.

The Grand Central, near the Smuggler, will be extensively worked the coming season. A cross-cut tunnel 440 feet long cuts the vein, which shows a pay-streak of an average of 20 inches. The character of ore is similar to the Smuggler, but not so high grade. The average value of entire mineral streak is $40 per ton, in gold and silver.

Parallel with the Sheridan is the Emily, that is showing up nicely, and will probably begin shipping ore in the spring. It is from 5 to 7 feet between walls, with average pay streak of 2 feet, carrying gold, silver, and copper. The mine is being developed by tunnel.

The Amsborough, the extension of the Revenue, is being worked under lease, and some ore has been shipped. The ore closely resembles that of the Cimarron.

The Memphis, which crosses the Cleveland at right angles, is looking well, and will probably become a producing mine next season. West of the Memphis are the Pandora and Oriental. These with the Sneffles claim are on a large, well-defined gold-bearing vein the width of which between walls is about 12 feet.

The Pandora and Oriental promise a rich production in the future. Over 40,000 tons of pay ore are exposed in the workings, of a character easily worked under stamps. The property is developed by a cross-cut tunnel 170 feet in length, has seven levels that aggregate 2,270 feet, six winzes that aggregate 647 feet, and a shaft 40 feet deep, making a total of 3,127 feet of development work. No pumping or hoisting machinery is used, the exit being through the cross-cut tunnel. But a very small amount of ore was extracted during the year, but that which was worked averaged $225 per ton. This company owns a 40-stamp mill, a short distance from the mines, the ore being transported by a tramway connecting mines and mills.

William Weston furnished the following relative to the Cincinnati mine:

"The now justly celebrated gold vein known as the Cincinnati is situated on the head of the Savage Fork of the San Miguel River, in the San Miguel mining district, and distant from Ouray by trail about 11 miles, this trail being via Imogene Basin. The adjoining extensions of the Cincinnati are the Argentine and Red Cloud claims on the south, and N. W. H., jr., on the north.

"The following are some of the mill-runs of ore taken out of the mine during the trial working. The ore was sampled by Munn Bros., Ouray, and sold to D. C. Hartwell, esq., agent for the Pueblo Smelting and Refining Company: 1,266 pounds, 78¼ ounces gold, 23⅛ silver; coin value, $1,436.17. The above was a streak 2 feet 6 inches in width shot down and sacked without sorting.

"The 'A' shaft was then commenced, and the ore sorted into two classes. One thousand pounds of first-class yielded per ton 93½ gold and 26¼ ounces silver; coin value, $1,962.34. The second class milled $60 per ton, and the lot of 1,005 pounds from the same shaft milled 71¼ ounces gold per ton and 20 ounces of silver; coin value, $1,497. Since that time (October 1) the 'A' shaft has been sunk 36 feet, and the gold has lasted equally rich all the way down.

"The Cincinnati Company are sinking two shafts, and driving a long tunnel to connect with them. This will be explained by the annexed cut, so that in the spring the ore in which they are now sinking can be stoped out without hindrance by water. The drift will in all probability connect with the first shaft by the middle of May.

"By this tunnel the mine will be drained at an average depth of 100 feet below the surface; that is to say, it will free 100 feet of 'back' or stoping ground for its entire length of 1,500 feet.

"The Cincinnati is an undoubted true fissure vein, averaging in width about 12 feet between the walls, and carrying from 6 to 8 feet of ore-bearing quartz. It is in a trachyte formation or 'country rock,' and dips to the west, with a course about northeast to southwest; altitude, 11,200 feet above sea-level.

"The character of the ore is free or native gold, associated with galena, copper, and iron pyrites, and zinc-blende in a matrix of white crystalline quartz and what is called here 'rose quartz,' a silicate of manganese. On the surface there is a great deal of the black oxide of manganese, but this disappears with depth.

"The Argentine, which has been worked for several months past, is one of the most noted mines in this district. The lead is from 8 to 12 feet wide, 1 foot of which along the foot wall shows a large amount of free gold, and is unusually rich. During the summer a large amount of ore has been reduced by a mill above Telluride, and with satisfactory results."

On the same vein with the Argentine are the N. W. H., jr., and Flora. Both claims have shipped a small quantity of very rich ore, but as yet are limited in the quantity of development.

*Bridal Veil Basin* possesses some of the finest looking prospects in the county, and I can see no reason why, with an equal amount of development, the output should not be equal to Marshall Basin. The veins are broad, and the mineral improves with depth. Directly across this basin runs the mother vein of the country, standing up bold and strong, and plainly visible for miles around. This lode, upon which Mr. Knudtson has two locations, the Millionaire No. 1 and No. 2, is 25 feet between walls. A tunnel is now being run which will tap the vein at a depth of 150 feet, where it is hoped that it will strike a fine body of mineral. From all directions lodes and cross-lodes are seen, all running direct from every point of the compass to the spot at which the cross-cut intersects the vein of the Millionaire. While the work so far does not show anything of any account, it being all of the nature of dead-work, yet the Millionaire is universally regarded as a valuable property.

The Blanchie Getts, just above the Millionaire, is opened by a 60-foot drift, exposing a vein 5 feet in width, in which is a streak 18 inches wide carrying free gold.

The Ella J. Freeman is opened by drift 50 feet, disclosing vein 7 feet between walls; pay streak averages 22 inches; character, free gold in quartz.

A little higher up is the Little Eva, an extension of the Ballard mine, which lies just over the summit, in Bear Creek. The vein here is 3 feet in width, and is opened by a drift to a depth of 35 feet, showing the same character of ore for which the Ballard mine has become quite noted.

The American Exchange, lower down the mountain, has a vein 4 feet wide, having a mineral streak of 14 inches of galena ore, which mills 47 ounces silver and 33 per cent lead. A cross-cut tunnel is being run to tap this vein at a depth of 160 feet.

The Laura has a drift 25 feet, at the breast of which is a clearly-defined vein of sugar quartz 6 feet wide, in which are two streaks of free-gold ore. The ore is free milling and runs sufficiently high to pay expenses of development from grass-roots.

Directly opposite the town of Pandora is the Cliff lode, one of the most promising in this locality. The vein is 6 feet wide; pay-streak 28 inches; character is free-milling, gold-bearing quartz.

The Birthday, an adjoining location, is very similar, and without doubt is as valuable as the Cliff. This lode is owned by the Silver Gold Company, of Newport Ky., who are pushing a cross-cut to tap the vein 100 feet below the surface, from which point depth is rapidly gained by drifting. This company also own the Waring and Tecumseh lodes. The first named crosses the Millionaire, and in a 40-foot drift shows a vein 5 feet wide, the ore free gold.

The San Miguel Gold and Silver Mining Company owns a group of three claims the Josephine, Slodge, and Yngling, that will be developed by a cross-cut now being driven. These are strong veins, about 6 feet wide, containing a free-milling, gold-bearing quartz, with average value of $55 per ton.

Other properties as promising are the Pan Handle, White Lily, Uncle Tom, Breckenridge, Waterloo, Diamond Cross, Mayflower, Gold Maid, Little Belle, Jumbo, Summit; W. T. Sherman, Mona, and probably fifty others whose 20 and 30 foot holes show streaks of fine-gold ore.

Bear Creek possesses numerous prospects, many of which will soon be producing mines.

The Ballard has been one of the steady producers. During the past summer the owners of the Ballard did development work on the lead to the extent of nearly 300 feet of drifting, taking out a large amount of gold-bearing quartz, which was packed down to the Golden Group and Andrus mills. The results on an average have been very satisfactory. In addition to the above work, the trail was put in first-class condition, and a comfortable building erected for the accommodation of employés. This mine is now being worked on a contract to extend the middle level 300 feet further. The contractors now report that they have 4 feet of solid gold-bearing quartz in the breast of the drift. On the completion of the contract it is the intention to begin stoping.

The Nellie has shipped some ore. It is opened by two drifts that aggregate 200 feet, disclosing a 4 foot pay streak of gold-bearing ore that mills about $25 per ton, net.

The Upper San Miguel Gold and Silver Mining Company began a thorough course of systematic developing on its numerous claims in this locality. No stoping has been done, but the ore extracted in running levels and drifts was sent to the mills, and from all accounts proved sufficiently rich to induce the company to continue the work of developing.

Other promising properties that deserve mention are the Elizabeth, Mayflower, Savage, Golden Chief, Kansas, and Silver Chief.

In *Lower San Miguel district* most of the placers have been idle, and but few of the mines have been worked. In Turkey Creek the Gold King Mining Company has been continually at work, and from all accounts with good success. This company owns the Gold King, Minnie Myrtle, and some five or six other claims. The Minnie Myrtle is developed by a 475-foot tunnel that connects with a level 360 feet long. The character of the ore is gray copper and galena, which runs about $190 in silver per ton. The pay streak averages 8 inches. The Gold King mine has the most development, and can boast of six levels or drifts on the vein, all connected by winzes. The upper level cuts through the top of Silver Mountain, and gives an outlet on the Ophir side of the same. The pay-streak in this mine is 4 feet wide. The ore, which is free milling, averages $25 per ton in gold. A tramway extends from the mine to the stamp-mill, three-fourths of a mile, and can transport 50 tons per day at a cost of 30 cents per ton. The company owns at the foot of this tramway a 20-stamp mill run by a 30-horse-power engine. Developments will be pushed during the winter, and if the other property of this company fulfils the promises given by surface indications, the capacity of the mill will be increased during the coming summer.

The Palmyra mine is opened by a drift 350 feet in length, throughout the entire length of which is plainly visible the mineral streak, that has widened from a thickness of about 4 inches on the surface to 12 inches of solid mineral, that mills without sorting upwards of $200 per ton. One hundred and sixty feet from the mouth of the drift a shaft has been sunk to a depth of 75 feet, in the bottom of which the mineral streak has widened to 18 inches. In this streak there is not a pound of barren rock, and the entire product is sacked and shipped without sorting, and mills upon an average $225 per ton. Explorations on the surface along the entire length of the vein indicate that the pay ore is continuous. The property is admirably located for economical working, and it is unnecessary to perform one foot of dead work in the shape of cross-cuts, &c. The mountain is very steep at this point, and throughout the course of the vein a depth of two feet will be attained for every one run in the drift on the vein.

On the Mesa, about 3 miles from Ames, is the Hard Cash mine. It is a contact vein with a 13-inch pay streak running 175 ounces silver, 40 per cent. lead, and 3 per cent. copper. The ore is galena and gray copper and chlorides, and this is supposed to be the mother vein lying in and around Turkey Creek. The developments consist of two tunnels, one of 130 feet and the other 200 feet long. Two shafts, one 32 feet, the other 60 feet deep, the latter being sunk upon the foot-wall. Most of this work is done in slide. Developments are being pushed forward.

*Iron Springs district*, or rather Ophir district, the first named being used only in location certificates, is one of those localities that come slowly but surely to the front.

Ophir, the chief camp, is situated in a small valley between Yellow and Silver Mountains. Since 1877 the town has continued to advance in prosperity, and never before did the future look brighter.

On Lookout Mountain the Summit mine has been continually shipping ore. A cross-cut tunnel intersects the vein about 500 feet from the surface, where levels are run disclosing large bodies of ore. The other developments consist of two drifts. The upper drift is 390 feet, the lower one 610 feet long. Winzes connect these drifts. The vein is about 5 feet between walls, the pay streak about 2 feet.

The Tip Top, which is an extension of the Summit, together with the Lookout mine, is owned by the Duquesne Mining Company. The Tip Top has its outlet through the workings of the Summit mine, and the Lookout is worked by a cross-cut tunnel that cuts the vein about 300 feet from the surface. These mines have been worked considerably, having kept a train of 75 jacks busy packing ore to the Ames smelter. The character of the ore is sulphurets and galena. averaging 150 ounces silver per ton and 28 per cent. lead.

The Nevada, on Yellow Mountain, owned by the Evans Mining Company, is situated a short distance above the main stream of the Howard's Fork, on the east side of the same, and perhaps 500 feet above the level of the gulch, and running nearly parallel to the gulch. The claim is favorably situated for easy development. A cross-cut of 420 feet taps the vein at level No. 3. This level has been driven but a short distance, some fifty feet on the vein, and shows a strong vein, carrying good mineral. From level No. 3 a winze and shaft connects with level No. 2, 100 feet above; from this winze drifts at 45 feet above No. 3 level have been run a short distance. At about 20 feet above this drift, the main one, No. 2 drift has been run 75 feet west. From these drifts but little stoping has been done. Passing up through the shaft to level No. 2 there are 350 feet of drifting on the vein, and that stoping has been done to the extent of some 60 feet high by 250 feet in length. From this stope about 265 tons, assaying 175 ounces silver, has been milled. A small stope is being worked west of the shaft and below No. 2 level. This shows splendid ore, and probably the same ore-body continues below that has been stoped above this level. No. 2 level is connected with the outside by a cross-cut connecting with the What Cheer tunnel; also by shaft through to level No. 1. About 300 feet of drifting has been done and considerable stoping above. About 25 men are employed in the mine, mostly engaged in opening ground.

The What Cheer mine is an extension of the Nevada, and is worked through the same openings; is the property of Messrs. Ross and Folsom. But little work has been done on the No. 3 level and none between No. 3 and No. 2. On No. 2 level, which is opened by a tunnel belonging to the What Cheer, but used in common with the Nevada, considerable drifting has been done and the heading shows good mineral and a strong vein. The old workings or discovery on this property consisted of a drift through a small hill some 100 feet, the highest point of which was about 25 feet above the drift. Out of this ground over 50 tons of ore were taken that yielded from 100 to 140 ounces silver per ton. A cross-cut 280 feet in length has been run to cut the vein 25 feet lower, and 500 feet east of the present workings. About 50 feet remains to run before the vein will be reached.

The Caribou, on Yellow Mountain, is the property of the American Midland Mining Company. This property is developed by a cross-cut tunnel of 200 feet, tapping the vein 175 feet deep. An air shaft connects with the surface. A winze 180 feet deep, with a whim for hoisting, has been sunk from the tunnel level. From this winze drifts are driven every 60 feet on both sides of winze. On the west the drifts extend about 200 feet, and on the east 100 feet. These drifts are connected every 100 feet by winzes, thus blocking the ground out in blocks 60 by 100 feet each. A little over two blocks have been stoped out. From 500 to 700 tons have been shipped and milled from 65 to 125 ounces and from 50 to 60 per cent. in lead. Several lots have milled as high as 150 ounces per ton. The ore streak as shown in the workings runs from 6 to 15 inches in width. About 25 men are employed.

The San Juan mine, on Yellow Mountain, is under the management of the Big San Juan Mining Company, which is at present working on an 8-inch streak of gray copper ore, quite similar to the gray copper from the Fox. The average force is 8 men, and the mineral is being shipped as fast as produced.

The Butler mine, that has been idle for some time, started work under lease about October, since which time exploration and development have been energetically pushed. At present the development consists of a cross-cut tunnel 180 feet long, a shaft 125 feet deep and about 300 feet of levels.

The Silver Bell, which is an extension of the Butler, has two drifts on the vein about 75 feet apart, connected by three winzes. A cross-cut tunnel taps the upper level, which is 350 feet long, and furnishes an easy outlet for the ore. On a level with the lower mine level a drift has been run in on a vein, called the No Name, for some distance. From this drift a cross cut of about 100 feet has tapped the lower Silver Bell level at a point nearly 100 feet to the left. This drift is 350 feet long, showing the same character of ore and vein matter as above. This mine is in excellent shape to furnish a large amount of ore, as very little stoping has ever been done. The ore is galena, averaging 210 ounces silver and 25 per cent. of lead per ton.

The Terrible, the west extension of the Silver Bell, is developed by two tunnels; the upper tunnel is 100 feet, the lower tunnel 175 feet long. The upper tunnel cuts the vein at a depth of 75 feet, at which point levels are run each way 75 feet. The lower tunnel is 190 feet below and 400 feet to the west; cuts the vein at a distance of 193 feet. The ore is similar in character to that found in the Silver Bell.

The Crown Jewel, on the Ophir side of the range, is an extension of the Palmyra, in Turkey Creek. The mineral of this claim is a fine-grained galena thickly impregnated with gray copper that averages 150 ounces silver and 30 per cent. lead per ton. The mine is opened by drifts that aggregate 600 feet.

On Saint Bernard Mountain the Fox lode is being extensively developed by a shaft. The mineral streak is about 12 inches of almost pure copper that carries between 300 and 400 ounces silver per ton.

The Garibaldi near the Fox, has been shipping some ore from a pay streak of 14 inches of solid ore, which is netting $75 per ton.

At Trout Lake, on Mineral and Sheep Mountains, is the property of the Trout Lake Mining Company, the Mountain Queen, Hidden Treasure. Little Chief, Vermillion, and Yellow Jacket claims. The principal amount of development is on the Hidden Treasure lode, on which a cross-cut tunnel has been run 250 feet to intersect the vein. The vein is opened in another place by a tunnel 40 feet long, and shows the vein to be 4 feet in width, with a pay streak of 7 inches thick, averaging 68 ounces silver per ton. The mineral is a sulphuret, showing a large amount of brittle silver. This company has developed its properties with a view to treat its own ores by concentration, and has done mostly dead work. About 100 tons of ore is on the dumps from surface openings. Concentration works have been contracted for and will be erected in the spring.

The Black Bear possesses a pay streak of 3 feet and 6 inches. The ore is galena and quartz gangue, averaging 25 ounces silver, $\frac{2}{10}$ ounce gold, and 20 per cent. lead. About 80 tons of ore was removed in sinking the shaft 75 feet deep.

The following is a statement of ore shipped during the year 1883 from Iron Spring mining district:

| Name of mine. | Ore. | Silver. | Gold. | Lead. |
|---|---|---|---|---|
| | *Tons.* | *Ounces.* | *Value.* | *Pounds.* |
| Nevada | ........ | 32, 650 | .......... | 155, 000 |
| Silver Bell | 140 | 16, 800 | .......... | 67, 300 |
| Caribou | 200 | 10, 000 | .......... | 200, 000 |
| Summit | 140 | 18, 480 | .......... | 140, 000 |
| Lookout and Tip Top | 160 | 9, 600 | .......... | 160, 000 |
| Mohawk | 2 | 232 | .......... | 960 |
| Globe and Suffolk | 7 | ...... | $910 00 | .......... |
| Grand View | 8 | 3, 600 | .......... | 2, 400 |
| Winnifred | 3 | 300 | .......... | 2, 000 |
| Santa Cruz | 35 | 2, 800 | 36 00 | 21, 000 |
| Tidal Wave<br>Pitkin<br>Butler<br>Spar<br>Deadwood<br>Staatsburg | 21 | 2, 100 | | 12, 600 |
| Total | ........ | 96, 562 | 946 00 | 761, 260 |

The Gold King mine.—This ore carries an average of about 5 per cent. copper. No returns nor data for an estimate of ore mined at the Gold King lode were obtained. The 20-stamp mill in Turkey Creek Basin, over the mountain from Ophir, was run for five or six months on this ore.

The ore shipped from Trout Lake mining district, and also from vicinity of Ames, San Miguel County (late part of Ouray County), Colorado, during year 1883 was: From San Juan, Fox, Garibaldi, Beatty's, and Jones & Co.'s mines, Trout Lake district 2,500 ounces silver, and 6,400 pounds lead, and 5 per cent. copper; from Hard Cash, Colonel Keim's, and Sunlight mines, vicinity of Ames, 3,400 ounces silver and 4,000 pounds lead.

The San Miguel Journal publishes the following statement of the production of this county for 1883:

| Description. | Product. | Value. |
|---|---|---|
| Iron Springs: | | |
| Silver ........ ounces.. | 96, 562 | $107, 184 |
| Lead ........ tons.. | 381 | 60, 480 |
| Gold | ............ | 946 |
| | | 168, 610 |
| Trout Lake (in same county): | | |
| Silver ........ ounces.. | 5, 900 | 30, 180 |
| Lead ........ tons.. | 10 | 860 |
| | | 31, 340 |
| Gold King works, silver | ............ | 47, 000 |
| Aggregate value | ............ | 246, 950 |

As I stated in the conclusion of the review of Ouray County, considerable difficulty has been experienced in arriving at a proper distribution of the production of this and Ouray County, of which it was formerly a part, from the fact that many of the statements and reports have the production of certain mines which are now in San Miguel County in

Ouray. After a very careful analysis of all the data on the subject in my possession, I have placed the production of this county for 1883 as: Gold, $125,000; silver, $250,000; total, $375,000. This is largely in excess of the production of the parent county for the prior year, and, added to the production of what was left of Ouray County for this year, $520,000, makes a total production of what was originally Ouray County of $895,000; an increase from $230,000 in 1882.

### SUMMIT COUNTY.

Summit county lies on the Pacific slope of the Snowy Range. The area of this county is much smaller than formerly, as the legislature during its last session created from the western portion Eagle and Garfield Counties. With the exception of Eagle River, this county still retains the principal mining districts, viz, Union and Ten Mile.

*Ten Mile district* embraces the valley of Ten Mile Creek, within whose boundaries are Jack, Sheep, Elk, Chalk, and Cooper Mountains.

*Union district* lies east of Ten Mile, and embraces Montezuma, Decatur, Chihuahua, Breckenridge, and the Blue River. Although some of the largest producing mines of this county were not worked and others to a limited extent, the year was successful, owing to the fact that a number of new prospects became producing mines during the year. This is apparent more especially in the vicinity of Breckenridge, and Montezuma, whose season has been a progressive one, and the stability of these camps has been strengthened by the improvements and developments in the mines as well as by the advent of the railroad. But in Ten Mile district there is either a lack of energy, confidence, or capital among the mine owners that has thrown the district into a dormant state, from which it will require considerable time to recuperate.

The first silver-bearing lode discovered in Colorado was in this county, on Glacier Mountain, near Montezuma, in July, 1864, and though it has never amounted to anything as a producer, it led to the great silver excitement and development of the Clear Creek County silver district.

In the early years of Colorado the placers along the tributaries of the Blue River were among the most productive in the State, Georgia, French, Hamburg, and Gold Run Gulches being the richest; yet large quantities of the precious metal was produced from Swan River, Ten Mile Creek, Illinois, Iowa, and Ryan Gulches. The yield of the placers in this county has always been good, and mining has been carried on there every summer since the first discoveries. Ten Mile district does not show the life it possessed two years ago. Almost every branch of mining is at a standstill, with a future equally dark. The ores as a general rule are low grade in silver, and on account of the lead and iron contained they are desirable ores for smelting purposes. The formation of the veins are principally contact, averaging 4 feet thick, composed mostly of carbonate of lead and carbonate of iron.

On Sheep Mountain is the property of the Robinson Consolidated Mining Company, that during 1881 and 1882 created great excitement on account of the wonderful production that was the principal cause of swelling the Summit County production in 1881. This property is now worked under lease. According to the terms of the latest lease the lessee agrees to pay the company the following royalties: On ore under 35 ounces to the ton, $3 per ton; ore of 35 ounces and not exceeding 40, $4 per ton; ore of 40 ounces and not exceeding 45, $6 per ton; ore of 45 ounces and not exceeding 50, $9 per ton; ore of 50 ounces and not exceeding 55, $12 per ton; ore of 55 ounces and not exceeding 60, $18 per ton; on all ores over 60 ounces, in the proportion of $18 per ton per 60 ounces. Settlements are to be made with the company on the first of every month. The lessee agrees to employ a force of not less than sixty-five men, and extract at least 1,500 tons a month, providing the ore is contained in the mine and available. He also agrees to diligently prosecute development work on the line of the ore-chutes below the thirteenth level and keep development work at least 50 feet ahead of the extraction of the ore.

The Idalia, an adjoining property to the Robinson, has been idle most of the time, and but little advancement in development has been made.

The Wheel of Fortune, on top of Sheep Mountain, has been worked and some ore shipped. Developments have been pushed, and large bodies of ore are now blocked out ready for extraction. The ore is a carbonate of lead, found in the contact, and is about 4 feet thick. The grade is only fair, averaging something like 20 ounces silver per ton.

On the Gray Eagle some exploration and development work has been done, and, as reported, the prospects for finding a large body of ore is good. This property is worked by lessees, who have spent some $6,000 or $7,000 in their researches.

The Crown Point, owned by the Graphic Mining Company, has been put in good shape, and is now one of the largest producers in this district. In tunnel, drifts, and levels is an aggregate of over 1,000 feet of development. The ore is of a better grade than found anywhere in this vicinity, the average per shipment being about $100 per ton.

The Snow Bank is developed by a shaft 100 feet deep, with an aggregate of 100 feet in levels. The ore-body is from 4 to 10 feet thick, it being lead carbonates and sulphates of iron, that run from 12 to 15 ounces silver and 20 per cent. lead per ton. The ore is refractory, and requires concentrating to be made marketable. No shipments were made during 1883, but over 3,000 tons of ore was extracted and now lies on the dump.

The Boston and Sheep Mountain Mining Company own seven claims on this mountain, all adjacent to the Robinson Consolidated Mining Company's property. No ore has been mined from this group during 1883. The principal development, and that which promises best results, was a shaft sunk 162 feet on the Zonars lode and designed to tap the Robinson ore-chute on its dip, but the work was discontinued before the desired result was attained, the necessary depth to catch this ore-chute being 320 feet.

The Little Chicago is developed by an incline shaft on the vein 288 feet deep. A tunnel 640 feet long cuts the vein intersecting the shaft at the 240 foot level. At this point there is 700 feet of drifting on the vein, which is a contact, with an almost vertical dip, and radically different from any other mineral vein on Sheep Mountain. It has a sedimentary rock, giving a strong lime reaction for a foot wall and a yellow-colored porphyry for a hanging wall. The bulk of the vein filling is feldspar and decomposed porphyry, the ore when it occurs being a coarse cube galena intimately associated with pyrites of iron.

The Nettie B. Forrest mine is being worked by an incline 120 feet long. The drifts and upraises from this incline aggregate 450 feet. From the bottom of the shaft, which is 34 feet, there are about 250 feet of drifts on the vein. The Nettie B., as it is mostly called, is a contact vein, between a micaceous sandstone cap and a lime foot wall; one of the peculiarities of this vein is that it dips with the contour of the mountain at an angle of about 20 degrees, attaining greater depth as it descends the hill, the contour of the mountain being about 15 degrees. The vein from the outcrops to about 90 feet from the surface is badly broken, the ore being bunchy, the bulk of it being an oxide of iron of good quality, and is in demand as a smelting flux, running 45 per cent. excess in iron and about 9 ounces in silver; the ore associated with it being a carbonate of lead running about 40 ounces silver and 15 per cent. lead per ton. The main objection to this ore is its excessive moisture. Below the 90-foot level the character of the ore radically changes into an iron, heavy in sulphur and void of either silver or lead.

The West side, on Fletcher Mountain, was, during the early part of the year, worked by lessees, but on account of litigation was closed down. The ore is a sulphuret in quartz, running from 50 to 80 ounces silver per ton.

The Nova Scotia Boy No. 2, owned by the Crœsus Mining Company, is being put in a condition for production in 1884. Until recently the development consisted of a few open cuts and a tunnel 25 feet long lower down the mountain. This tunnel will be pushed until the contact is found.

But very little is being done on Jack Mountain. The Ida L. Bledsoe, Queen of the West, and the Delmonica have been worked but very little and but a very small quantity of ore shipped.

On Cooper Mountain, the Reconstruction and Storm King have been shipping some ore and pushing explorations. The ore is a low-grade carbonate of lead.

The Aftermath, the property of the American Mining and Smelting Company on Elk Mountain, has been producing regularly under lessees. The property is worked through an incline tunnel 690 feet long, having 11 levels, or a total of 2,500 feet. The ore, which is carbonate of lead, averages 25 ounces of silver and 25 per cent. lead.

The Milo mine, adjoining the Aftermath, has an outlet for its production through the tenth level of the Aftermath. The ore is a carbonate of lead and sulphuret of iron, averaging 25 ounces silver per ton. The developments consist of a shaft, or rather an incline shaft, 550 feet deep, with levels at every 50 feet, which in all aggregate about 1,500 feet.

Of the White Mail, one of the best producers in this district, no accurate information of the amount of development or of the character of the ore has been obtained.

The Matchless mine has been idle.

*Union district* embraces that portion of Summit County in the vicinity of and to the northeast of Breckenridge; the principal camps in addition to Breckenridge are Montezuma, Lincoln, Decatur, and Chihuahua. The placers have not been yielding as largely as formerly, many of them being idle or being put in condition for future working.

The Peabody Placer, owned by Lilon Peabody, in Gold Rim, has been worked with some success. The property possesses 3 short flumes, 200, 300, and 400 feet long, respectively; these flumes are 2 feet wide, 20 inches high, and give a supply of about 130 miners, inches.

The property of the Gold Rim Placer Mining Company was not worked during the year, but preparations are now being made for extensive work.

The Galena and Delaware Gulch placer was worked but very little on account of litigation; the property is well supplied with sluices and a Little Giant hydraulic.

The Ryan Gulch placer has likewise been idle, litigation being the cause. This property is well supplied with hydraulics, and if sufficient water could be obtained, the property would be equal in production to any in this district.

The Fuller Placer Mining Company consists of the Maggie placer, 122 acres; the Fuller and Crome placer, about 160 acres; the May lode claim, on which is a tunnel 130 feet, the formation being quartzite and lime; the character of the ore is galena and gray copper, carrying native silver, the mill-runs averaging 150 ounces silver per ton; the Nannie Houston lode, developed by a shaft 46 feet deep, showing a 20-inch pay-streak similar in character to the May lode; the Germania lode, which is developed by a tunnel 280 feet long, the pay-streak being from 10 to 20 inches wide, carrying sulphurets and carbonates that average 90 ounces silver per ton. None of this property has been worked during the year, beyond working the annual assessment. From reliable information obtained, I understand that machinery has been purchased, and as soon as erected the property, both placer and lode claims, will begin to produce.

The Salt Lick placer has been successfully worked. This property possesses a flume about 600 feet long, the water supply being about 60 miners' inches.

The Blue River Mining Company owns about 400 acres of good placer ground on the Blue River. The surface only has been worked, the property possessing but very little development.

On Negro Hill, east of Breckenridge, is the Bunker Hill mine. The formation is porphyry hanging wall and lime foot wall. The vein, which is 3 feet wide, runs due east and west. The ore averages 6 inches to a foot, the character being mostly a lead carbonate, averaging from 40 to 60 per cent. lead and from 20 to 45 ounces silver, and $\frac{1}{4}$ ounce gold per ton. The developments consist of two shafts, one being 100 feet deep, the other 75 feet. A drift 30 feet below the surface extends between the two shafts, which are about 100 feet apart. A drift also extends about 20 feet west from the 100-foot shaft. Another drift, 20 feet below the one just mentioned, extends 20 feet at present, but is being rapidly pushed. About 300 tons of ore were extracted while running these developments, which, on account of the low price of lead, still remains upon the dump.

The Washington mine, adjoining the Bunker Hill, together with the Uncle Sam and Ella, adjoining properties, are owned by Joseph Watson. These mines are thoroughly developed and equipped, nearly $90,000 having been expended upon them. In addition to the hoisting plant is a concentrating mill employing 20 stamps and other auxiliaries providing the facilities necessary for dressing the low-grade ores and rendering the entire product marketable. But a very small amount of ore was shipped during 1883, but the indications are that during the coming year the production will be quite large.

The Mayo is showing signs of improvement as development progresses. The ore, which is a carbonate of lead, is of higher grade than that found in the Washington. Machinery has recently been erected, and development work will be pushed the entire winter.

On Mineral Hill the Cincinnati has been a regular shipper. The developments in tunnels and shafts aggregate over 1,000 feet; the mineral being a carbonate of lead averaging 65 per cent. lead and 16 ounces silver per ton.

The Pennsylvania Breckenridge Mining Company is working quite a large force in developing.

On the Seymore, developments continue, and a small quantity of ore has been shipped.

The Mineral Hill Tunnel Company's tunnel is now about 1,225 feet long, and is the most extensive continuous workings on the hill. But a very small amount of ore is extracted and shipped, the company wishing to first get their property in shape.

The Seventy-Nine has shipped some ore, although the developments hardly aggregate 100 feet. Their ore is galena, which averages 40 per cent. lead, 25 ounces silver, and some gold.

The Gibson Hill Mining Company's property is composed of twenty patented claims, situated on the slope of Gibson Hill, McKay mining district, about a mile from Breckenridge. They are working twelve men steadily, and are doing development work principally, but are taking out enough ore to pay all expenses. The ore is a galena, and the coarser part is shipped as taken out, and nets from $60 to $75 per ton. The second-class ore is being concentrated by Messrs. Newcomb and Musgrove at the Elyria concentrator.

The Elkhorn, on the west slope of Negro Hill, near the town of Breckenridge, has an aggregate of 490 feet of delvelopment in shafts, tunnels, and levels. About 60 or 70 tons of ore were extracted while making these developments; the average value of that extracted being $45 silver, $13 gold, and 65 per cent. lead. In the workings some 300 or 400 tons of ore of equal value are in sight, that will probably be extracted and shipped as soon as the mine can be cleared of water.

The Hildebrand is developed by a tunnel 175 feet long, extending through a hard quartz with small veins of mineral crossing at intervals carrying copper pyrites and antimonial silver. This tunnel will be extended to catch a larger vein some 60 feet farther on.

The Rose of Breckenridge is developed by a tunnel 850 feet in length running to cross cut that vein, which it is expected to do in the next 50 feet. This tunnel is the Colorado and New Mexico Consolidated Mining and Smelting Company's property, which in its course has cut half a dozen veins that show but small pay streaks of very rich ore, the character being mostly galena and zinc-blende, although some gray copper is found.

On Argentine Hill, the Fredonia, the property of the Lake Shore Silver Mining Company, is developed by an incline on the vein 100 feet. About 150 feet below and to the northwest another incline has been driven, cutting the vein about 150 feet from the surface. From this point levels are being run and stoping commenced. The vein is about 8 feet wide, and the entire vein matter will average 26 ounces silver per ton. The ore is a sulphuret, and lies between porphyry and dolomite. In addition to the regular shipments, fully $30,000 worth of low-grade ore has been thrown on the dump, which will be concentrated during the coming season.

About 10 miles from Breckenridge is the Warrior's Mark, which is again coming to the front as a producer. The ore averages $100 per ton, carrying brittle-silver, copper glance, and baryta. The mine is said to be in a condition to continue shipments for some time to come.

On the Swan the Rochester Queen has been idle and the I. X. L. has come to the front as a producer. This mine is probably the best developed in this locality, possessing, in addition to a tunnel 200 feet long, about 600 feet in shafts, winzes, and levels. The I. X. L. Mining Company own five locations, through which the presence and continuity of a fissure vein 91 feet in width have been established. It is one of the most remarkable leads in this section, and contains throughout its entire width a very fair average grade of material, principally of a free milling character.

On Brewery Hill is the Sac Tunnel, the property of the New York and Summit County Mining Company. This tunnel and the workings aggregate about 650 feet; contracts for additional work have been let, and arrangements are now being made for active operations.

The Rock Island placer, comprising 90 acres, has been idle. This placer is well supplied with water, and the timber is unequaled by any in the state.

The Silver Eel and Silver Eel Extension are being extensively developed by a cross cut tunnel, which, when finished, will be 450 feet long, cutting the vein at a depth of 250 feet from the surface; the ore, which is free milling, yields $40 per ton silver and gold. The width of pay-streak averages 30 inches.

The railroad passing near Montezuma has awakened mine owners, and during the past season more activity and real good has been accomplished than ever before during the existence of this camp. Numerous prospects have blossomed into producing mines, the only drawback being the lack of cars to transport the ores to market.

The Coaly, on Glacier Mountain, named after the discoverer, was located in July, 1864, and was the first discovery of silver in Colorado. This mine has yielded but a very small amount of bullion, and has been worked but very little save by open cuts along the surface.

The Harrison, the property of the Gem City Mining Company, on the eastern slope of Glacier Mountain, that has been idle so long on account of litigation, has finally settled all dispute, and is now one of the big producers of this section. The developments on the lode are two tunnels or adits which have been driven on the vein, and three open cuts showing the crevice and the discovery shaft—the aggregate being about 200 feet in all. Ore is shown in all the workings, and improves with depth, the character being gray copper and galena that averages about 60 ounces silver per ton.

The Belle East has shipped about 300 tons of ore during the year, it being a gray copper and galena. This property is developed by three levels, they being 85 feet one above the other. The level No. 1, or upper level, is 120 feet long. Level No. 2 is 200 feet long, and level No. 3 is rather a drift, being 750 feet long, and having an opening on the eastern slope of the mountain. Winzes connect these levels, and the outlet is through level No. 3.

The Herman mine, owned by the Herman Mining Company, has been shipping some ore. The crevice is about 6 feet wide and all the crevice matter pays for shipment, the average grade being between 60 and 70 ounces silver per ton. This is probably the largest ore-body in the district, and with development will probably be one of the largest producers. The present developments consist of a drift on the vein 70 feet. About 35 feet below this drift an incline shaft has been started which will be sunk 100 feet, when levels will be run.

The Silver King was developed considerably some years ago, and has laid idle until the present management took hold of the property. The developments consist of three adit levels with connecting winzes that aggregate 1,500 feet. The upper level, or level A, is 100 feet long; level B is 500 feet, and level C is 600 feet long. Contracts have been recently let to extend levels B and C each 50 feet more. Work has been confined to the two lower levels, the ore streak having increased both in quality and quantity, it having widened from 1 inch in the upper level to nearly 2 feet in the lower, or C level. The grade of the mineral is good, carrying ruby silver, gray copper, and galena. The body of mineral in sight has warranted the company in putting the Silver King mill in thorough repair, by putting in crushers, Cornish rolls, Hartz jigs, and buddles.

On the St. Elmo the drifts aggregate 450 feet long on the vein.

The Mark Twain is now developed with capacity for working 150 men in the stopes, but on account of the railroad not supplying sufficent number of cars, only about 14 men have been employed. The developments consist of a cross-cut tunnel 400 feet long, cutting the Mark Twain and St. Elmo veins. On the Mark Twain lode is a shaft 205 feet deep and an aggregate of 630 feet in levels. The pay streak averages 8 inches wide, of galena and gray copper, carrying about 140 ounces silver per ton. The workings are supplied with T-rails, ventilators, &c. Charles Buckland is manager.

The Mark Twain extension has been worked during the year.

The Montezuma Silver Mining Company own the Radical, Chautauqua, Erie, General Tell r, and several other lodes on Glacier and Teller Mountains, all of which are more or less developed by shafts, levels, and tunnels. The Radical and Chautauqua have been worked the most during the year. On the Radical the developments aggregate 400 feet of development in drifts, and on the Chautauqua the aggregate is about 1,500 feet. The shaft is 150 feet deep, and the upper drift is 150 feet long. A cross-cut tunnel, which at present is about 1,000 feet, is being run to intersect this lode at a depth 350 feet. The ore found in both of these claims is galena and gray copper, carrying on an average 90 ounces silver per ton.

The Blanche has been idle most of the year. For about two months the mine was worked, and some ore extracted and shipped. The developments consist of a shaft 75 feet in depth, and an adit on the vein 180 feet long. The ore is a galena averaging 80 ounces silver per ton.

On Lenawee Mountain the Eliza Jane is being systematically developed. At present the only work done consists of a shaft 70 feet deep and a cross-cut 40 feet long; but these are being pushed to put the mine in a condition for production.

On Collin Mountain the Waterman is developed by a drift 200 feet long and an open cut on the surface 75 feet. Lower down the mountain another drift has just been started, which is being pushed as fast as possible. The pay streak averages 10 inches of galena and gray copper that runs about 90 ounces silver per ton.

On Independence Mountain the Great Republic is developed by an adit 200 feet and a cross-cut 100 feet long; the vein is badly broken, but with depth the mineral is more solid, it being galena that averages 50 ounces silver per ton.

In the Horseshoe, in Pery district, near Decatur, the Bufa Mining and Milling Company are pushing development on the Bufa lode. Water filled the shaft and upper workings, and the company are now running a crosscut tunnel, which at present is 195 feet long. This tunnel will drain this property, and the ore is high-grade sulphurets, carrying gold and silver.

The Consolidated Silver Ledge Mining Company is not working at present. They have now between 400 and 500 tons of ore on the dump ready for shipment. The ore consists of galena, gray copper and gold, and gives returns from mill-runs of from 60 to 150 ounces per ton. The property is splendidly located for working.

The Royal Gorge Mining Company have a very valuable property situated in close proximity to the Silver Ledge, but the ore is very different from the Ledge, as it consists of an arsenical iron carrying gray copper, ruby silver, brittle silver, silver glance, gold and copper. The lode is exposed by nature for a distance of 106 feet, and is 2 feet in width where it crops out. At a depth of 10 feet it is 4 feet and 2 inches of the same character of mineral. The lode is clearly traceable for a distance of 1,200 feet, and is being worked by two adits. The property has paid from the first hour's work, as the ore was obtained at the surface and will average in value from 114 ounces to 325 ounces in silver value.

The Delaware and Commodore mines near Decatur have been extracting and shipping large quantities of ore.

The Piqua also has shipped considerable ore, it being galena and gray copper that carried on an average 115 ounces silver per ton. This mine is developed by a drift 200 feet long and a shaft 30 feet deep.

The Hunkidori has been steadily worked. The ore shipped averaged $120 per ton. Developments consist of two drifts that aggregate 390 feet.

My estimate of the production of this county for 1883 is, gold, $15,000; silver, $350,000; total, $365,000. This is a large falling off from 1882, caused principally by reduced production of the Robinson Consolidated Mining Company, which, during the years 1881 and 1882, was the largest producing mine in the county.

# CHAPTER V.

## DAKOTA.

The production of gold and silver from the mines of Dakota during the year 1883 did not vary materially from the amount produced in each of the two prior years, showing, however, a steady decline. From $4,000,000 gold in 1881 it fell off $700,000 in 1882, and $100,000 more in 1883.

The production of the Territory is confined to a few mines located in the neighborhood of Deadwood, in the Black Hills, comprising immense ore bodies of low-grade ore, of which the Homestake and Father De Smet are the principal. I have estimated the production of the Territory for 1883 to have been, gold, $3,200,000; silver, $150,000; total, $3,350,000, distributed among the three producing counties as follows:

| Counties. | Gold. | Silver. | Total. |
|---|---|---|---|
| Custer | $180, 000 | ............ | $180, 000 |
| Lawrence | 2, 900, 000 | $150, 000 | 3, 050, 000 |
| Pennington | 120, 000 | ............ | 120, 000 |
| Total | 3, 200, 000 | 150, 000 | 3, 350, 000 |

### LAWRENCE COUNTY.

Lawrence County is nearly equally divided between mineral and arable lands, and is 85 miles long and 32 wide. The county affords an abundance of pine timber for lumber and fuel, and in addition to the many valuable mines within its borders contains quarries of marble, granite, and sandstone. This county, possessing the most important mines in the Black Hills, still continues to furnish the principal portion of the precious metals obtained from Dakota. It has a variety of mines, placer, quartz, cement deposit rich in gold, and mines containing silver associated with lead.

*Whitewood district* contains the most profitable group of mines in this region.

The Homestake is the largest and most productive of all the mines on the great "mineral belt of the Black Hills."

To the north of this mine are located the Highland, Deadwood-Terra, and the Father De Smet, extending in an unbroken course 1½ miles from Gold Run to Deadwood Creek. The mines above named are different and distinct incorporations, the stock in the several companies being principally owned in the Eastern cities and Europe. The Deadwood-Terra is a New York incorporation, the Homestake, Highland, and Father De Smet being incorporated in California.

The Homestake.—This group embraces several locations, the Golden Star, Old Abe, and Homestake, whose ore veins, parallel to each other and separated by but a few feet of porphyry or waste rock, range from 50 to 350 feet in width, showing high-grade free-milling ore. It has been developed more than any mine in the hills. It has one shaft sunk to the depth of 597 feet, but their present active workings are on the 300-foot level. This is on a level with the 280-foot level of the Deadwood-Terra. There is at present a tunnel being driven at the rate of 100 feet per month towards the De Smet office, which is 4,000 feet from the Homestake works, and at this rate the tunnel will be completed in three years. In spring the 500-foot level becomes very wet, and for that reason, and to keep the supply of ore nearly up to the capacity of the mills, it has been deemed advisable to open new stopes that more men may be placed in the mine.

There are three large shafts, the Giant and Old Abe, of three compartments, the Star, a three-compartment, and on the vertical one of two compartments. Improved hoisting works have also been placed on the property. Fuel and timber are made available by means of a railroad 25 miles in length; the amount consumed every 24 hours is probably as much as 100 cords.

The following is an official statement of the bullion product of the Homestake Company during the calendar year 1883:

*Homestake bullion product, from January* 1, 1883, *to December* 31, 1883.

| Month. | Bars. | Ounces. | Fineness. | | Gross value. | | Premium. | Clean up. |
|---|---|---|---|---|---|---|---|---|
| | | | Gold. | Silver. | Gold. | Silver. | | |
| January | 213 | 1,439.80 | 813.0 | 173 | $24,197 57 | $263 62 | .......... | $24,461 19 |
| | 214 | 1,433.60 | 815.5 | 172 | 24,167 46 | 260 86 | .......... | 24,428 32 |
| | 215 | 1,731.61 | 814.0 | 172 | 29,137 58 | 315 11 | .......... | 29,452 69 |
| | 216 | 1,727.85 | 808.5 | 175 | 28,877 86 | 320 29 | .......... | 29,198 15 |
| February | 217 | 1,237.34 | 811.0 | 171 | 20,743 83 | 223 83 | .......... | 20,967 66 |
| | 218 | 1,262.80 | 810.0 | 175 | 21,144 56 | 234 07 | .......... | 21,378 63 |
| | 219 | 1,814.54 | 810.5 | 177 | 30,401 75 | 340 35 | .......... | 30,742 10 |
| | 220 | 1,801.90 | 812.0 | 176 | 30,245 85 | 335 95 | .......... | 30,581 80 |
| March | 221 | 1,540.45 | 806.0 | 179 | 25,666 21 | 292 45 | .......... | 25,958 66 |
| | 222 | 1,418.93 | 805.0 | 181 | 23,612 17 | 272 54 | .......... | 23,884 71 |
| | 223 | 2,020.25 | 805.0 | 177 | 33,618 63 | 379 06 | .......... | 33,997 69 |
| | 224 | 2,058.25 | 811.0 | 168 | 34,506 27 | 365 47 | .......... | 34,871 74 |
| April | 225 | 1,384.70 | 808.0 | 174 | 23,128 42 | 255 15 | .......... | 23,383 57 |
| | 226 | 1,379.80 | 804.5 | 179 | 22,946 75 | 261 97 | .......... | 23,208 72 |
| | 227 | 1,756.32 | 809.0 | 176 | 29,371 84 | 327 51 | .......... | 29,699 35 |
| | 228 | 1,784.07 | 816.0 | 168 | 30,094 08 | 316 69 | .......... | 30,410 77 |
| May | 229 | 1,501.60 | 812.5 | 172 | 25,220 67 | 273 28 | .......... | 25,493 95 |
| | 230 | 1,695.97 | 804.0 | 176 | 28,187 28 | 316 35 | .......... | 28,503 63 |
| | 231 | 1,061.50 | 812.0 | 166 | 17,817 85 | 186 11 | 5 56 | 18,009 52 |
| | 232 | 1,011.95 | 808.0 | 172 | 16,902 44 | 184 22 | 5 27 | 17,091 93 |
| June | 233 | 1,356.60 | 791.5 | 167 | 22,196 36 | 239 66 | .......... | 22,436 02 |
| | 234 | 1,581.90 | 807.5 | 172 | 26,405 88 | 287 98 | .......... | 26,693 86 |
| | 235 | 1,584.40 | 807.0 | 175 | 26,431 23 | 293 73 | .......... | 26,724 96 |
| July | 236 | 1,042.40 | 816.5 | 166 | 17,594 20 | 182 71 | .......... | 17,776 91 |
| | 237 | 1,048.20 | 812.0 | 172 | 17,594 59 | 190 77 | .......... | 17,785 36 |
| | 238 | 1,651.07 | 816.0 | 163 | 27,850 61 | 283 91 | .......... | 28,134 52 |
| | 239 | 1,641.97 | 815.5 | 170 | 27,680 13 | 295 12 | .......... | 27,975 25 |
| August | 240 | 1,290.60 | 816.0 | 161 | 21,770 12 | 219 06 | .......... | 21,989 18 |
| | 241 | 1,293.85 | 808.5 | 168 | 21,624 35 | 229 78 | .......... | 21,854 13 |
| | 242 | 1,649.40 | 815.0 | 171 | 27,788 34 | 298 30 | 8 66 | 28,095 30 |
| | 243 | 1,612.80 | 812.0 | 174 | 27,071 70 | 297 11 | 8 44 | 27,377 25 |
| September | 244 | 1,120.92 | 814.0 | 177 | 18,861 58 | 210 21 | .......... | 19,071 79 |
| | 245 | 1,129.10 | 809.5 | 167 | 18,894 19 | 199 25 | .......... | 19,093 44 |
| | 246 | 1,268.30 | 816.5 | 168 | 21,407 07 | 225 13 | 6 68 | 21,638 88 |
| | 247 | 1,273.50 | 821.5 | 150 | 21,626 46 | 200 51 | 6 74 | 21,833 71 |
| October | 248 | 1,257.28 | 812.5 | 166 | 21,117 11 | 220 44 | 6 57 | 21,344 12 |
| | 249 | 1,277.83 | 815.5 | 164 | 21,541 51 | 221 16 | 6 71 | 21,769 38 |
| | 250 | 1,680.23 | 793.0 | 163 | 27,543 62 | 289 35 | 8 59 | 27,841 56 |
| | 251 | 1,689.83 | 798.5 | 164 | 27,893 11 | 287 15 | 8 70 | 28,188 96 |
| November | 252 | 1,383.56 | 810.5 | 164 | 23,180 89 | 239 53 | .......... | 23,420 42 |
| | 253 | 1,382.06 | 805.0 | 170 | 22,998 62 | 248 57 | .......... | 23,247 19 |
| | 254 | 1,574.25 | 821.5 | 166 | 26,733 77 | 275 85 | 8 33 | 27,017 95 |
| | 255 | 1,559.90 | 817.0 | 169 | 26,344 97 | 278 61 | 8 22 | 26.631 80 |
| December | 256 | 1,200.54 | 819.5 | 165 | 20,337 83 | 209 05 | .......... | 20,546 88 |
| | 257 | 1,189.80 | 813.5 | 164 | 20,008 32 | 205 95 | .......... | 20,214 27 |
| | 258 | 1,642.50 | 821.0 | 167 | 27,875 82 | 289 65 | .......... | 28,165 47 |
| | 259 | 1,659.00 | 819.5 | 166 | 28,104 40 | 290 73 | .......... | 28,395 13 |
| Total | ...... | 69,104.96 | ....... | ........ | 1,158,485 85 | 12,434 15 | 88 47 | 1,170,988 50 |

*Homestake bullion product, &c.*—Continued.

| Month. | Gross returns. | Charges. | Net returns. | Where milled. | | Total milled. |
|---|---|---|---|---|---|---|
| | | | | 80-stamp mill. | 120-stamp mill. | |
| | | | | | | *Tons.* |
| January | $107, 540 35 | $1, 424 03 | $106, 116 32 | 5, 502 | 8, 194 | 13, 696 |
| February | 103, 670 19 | 1, 369 93 | 102, 300 26 | 5, 228 | 7, 710 | 12, 938 |
| March | 118, 712 80 | 1, 593 17 | 117, 119 63 | 6, 430 | 9, 850 | 16, 280 |
| April | 106, 702 41 | 1, 421 73 | 105, 280 68 | 6, 245 | 9, 700 | 15, 945 |
| May | 89, 099 03 | 1, 172 36 | 87, 926 67 | 5, 950 | 6, 040 | 11, 990 |
| June | 75, 854 84 | 1, 017 27 | 74, 837 57 | 3, 800 | 8, 650 | 12, 450 |
| July | 91, 672 04 | 1, 122 46 | 90, 549 58 | 6, 325 | 9, 850 | 16, 175 |
| August | 99, 315 86 | 1, 226 94 | 98, 088 92 | 6, 210 | 9, 490 | 15, 700 |
| September | 81, 637 82 | 1, 001 84 | 80, 635 98 | 6, 080 | 9, 185 | 15, 265 |
| October | 99, 144 05 | 1, 215 97 | 97, 928 05 | 9, 570 | 9, 800 | 16, 370 |
| November | 100,317 36 | 1, 221 65 | 99, 095 71 | 9, 360 | 9, 760 | 19, 120 |
| December | 97, 321 75 | 1, 187 42 | 96, 134 33 | 6, 650 | 10, 175 | 16, 825 |
| Total | 1, 170, 988 50 | 14, 974 77 | 1, 156, 013 70 | 71, 350 | 108, 404 | 179, 754 |

That Homestake ores carry a very considerable percentage of silver perhaps is not generally known, yet, as shown above, during the year 1883 the silver produced amounted to $12,434 and in the prior calendar year $12,309.

As compared with the prior calendar year the value of the product was:

| Year. | Gold. | Silver. | Total. |
|---|---|---|---|
| 1882 | $1, 193, 397 | $12, 309 | $1, 205, 706 |
| 1883 | 1, 158, 485 | 12, 434 | 1, 170, 919 |

The receipts and expenditures for the fiscal year ending May 31, 1883, taken from the official report of the secretary, Mr. Irvin C. Stump, were as follows:

RECEIPTS.

| | |
|---|---|
| Balance | $315, 585 24 |
| Saw-mill | 19, 966 32 |
| Blacksmith shop | 8, 610 37 |
| Machine shop | 1, 148 21 |
| Foundry | 25, 732 82 |
| Tailings | 249 30 |
| Bullion | 1, 196, 394 17 |
| Suspense | 7, 069 05 |
| Assay office | 1, 231 81 |
| Total | 1, 575, 987 29 |

EXPENDITURES.

| | |
|---|---|
| Mine | $361, 645 18 |
| Dead work | 30, 076 85 |
| Homestake shaft | 3, 964 13 |
| Golden Star shaft | 41, 163 64 |
| B. & M. shaft | 2, 535 47 |
| 80-stamp mill | 90, 980 74 |
| 120-stamp mill | 119, 426 42 |
| Superintendent's residence | 1, 931 80 |
| Saw-mill | 17, 458 09 |
| Machine shop | 1, 812 82 |
| Foundry | 20, 822 52 |
| Blacksmith shop | 4, 752 27 |
| Tramway | 15, 784 71 |
| Property purchase | 26, 730 11 |
| Tailing concentration works | 3, 950 26 |
| Roads and grades | 58 00 |
| Bullion | 15, 922 67 |

| | |
|---|---|
| Survey | $1,242 02 |
| Interest | 2,139 90 |
| Salaries | 14,230 00 |
| Taxes | 13,166 79 |
| Legal expenses | 5,897 97 |
| Expenses | 4,951 02 |
| Dividends | 600,000 00 |
| Cash in treasurer's hands | 169,527 17 |
| Cash in superintendent's hands | 5,816 74 |
| Total | 1,575,987 29 |

Father De Smet.—The mill of the Father De Smet is supplied with all the latest appliances for cheap and profitable reduction of ores. It has a 150-horse-power engine, and its machine shop is furnished with an iron lathe 18 feet in length, for the purpose of speedily repairing any portion when broken or worn. One hundred and thirty men are employed at the mine and mill and 300 tons of ore crushed per day. The ore is brought on cars a distance of some 800 feet from the ore chambers to the mill, through a tunnel on the third level. The upper two of the four levels have been worked out, leaving an open cut of 200 feet in depth, 250 wide and 475 in length. It is estimated that sufficient ore is in sight to continue to supply the mills for four years to come.

The following is a statement of the receipts and disbursements for the fiscal year 1883:

| | |
|---|---|
| Receipts | $354,554 42 |
| Disbursements | 258,747 13 |
| Net profit | 95,807 29 |

STATEMENTS.

| | | |
|---|---|---|
| January 1, 1883, balance on hand | $14,131 20 | |
| Net earnings for fiscal year 1883 | 95,807 29 | |
| December 31, 1883, disbursed six dividends | | 120,000 |
| Balance, overdraft | 10,061 51 | |
| Total | 120,000 00 | 120,000 |

| | |
|---|---|
| Total ore milled during year ... tons | 104,100 |
| Average value per ton | 3.40 |

The following statement of the operations of the Father De Smet, covering the calendar year 1883, has been furnished by Mr. Stump:

*Operations of the Father De Smet Consolidated Gold Mining Company for the year* 1883.

| Months. | Disbursements. | | | | | | |
|---|---|---|---|---|---|---|---|
| | Mine labor. | Mine supplies. | Transportation of ore. | Mill labor. | Mill supplies. | Sundries. | Total. |
| January | $9,405 00 | $2,191 50 | $1,175 85 | $2,844 00 | $4,713 20 | $11,170 45 | $31,500 00 |
| February | 7,117 20 | 908 45 | 998 85 | 2,596 00 | 3,721 90 | 2,657 60 | 18,000 00 |
| March | 7,567 45 | 572 19 | 1,260 75 | 2,888 00 | 5,808 22 | 3,903 39 | 22,000 00 |
| April | 7,504 15 | 635 91 | 1,140 75 | 2,819 75 | 3,842 57 | 2,556 87 | 18,500 00 |
| May | 8,101 85 | 648 60 | 1,284 00 | 2,696 75 | 2,506 12 | 1,762 68 | 17,000 00 |
| June | 7,739 55 | 1,415 99 | 1,218 75 | 2,782 90 | 4,744 85 | 2,397 96 | 20,300 00 |
| July | 7,187 60 | 1,209 10 | 1,156 50 | 2,927 25 | 7,368 73 | 2,880 82 | 23,000 00 |
| August | 7,487 35 | 1,590 98 | 972 25 | 2,943 50 | 9,854 13 | 2,151 79 | 25,000 00 |
| September | 6,626 70 | 1,374 75 | 958 00 | 2,413 50 | 5,975 89 | 2,651 16 | 20,000 00 |
| October | 6,477 80 | 340 25 | 951 00 | 2,504 90 | 8,374 41 | 351 64 | 19,000 00 |
| November | 6,145 65 | 978 52 | 1,033 50 | 2,454 50 | 9,439 10 | 1,051 27 | 19,000 00 |
| December | 6,388 70 | 1,493 58 | 1,052 25 | 2,507 00 | 5,968 32 | 1,390 15 | 18,800 00 |
| | 87,749 00 | 13,359 82 | 13,202 45 | 32,378 05 | 72,587 44 | 32,823 24 | 252,100 00 |

*Operations of the Father De Smet Consolidated Gold Mining Company*—Continued.

| Months. | Receipts. | | Miscellaneous information. | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Ounces of bullion. | Value of bullion. | Value of ore per ton. | Mine expenses per ton. | Mill expenses per ton. | Sundry expenses per ton. | Profit per ton. | Profit per month. | Ore milled. | Wood consumed. | Hours stopped. |
| | | | | | | | | | *Tons.* | *Cords.* | |
| January.... | $2, 523 10 | $42, 637 32 | $4 86 | $1 46 | $0 86 | $1 28 | $1 26 | $11, 137 32 | 8, 765 | 448. 00 | 42. 48 |
| February .. | 1, 649 98 | 27, 454 65 | 3 63 | 1 20 | 84 | 35 | 1 24 | 9, 454 65 | 7, 555 | 406. 50 | 67. 36 |
| March...... | 1, 925 35 | 32, 620 36 | 3 66 | 1 05 | 97 | 44 | 1 20 | 10, 620 36 | 8, 925 | 426. 00 | 30. 00 |
| April....... | 1, 615 42 | 26, 948 82 | 3 12 | 1 07 | 77 | 29 | 99 | 8, 448 82 | 8, 640 | 414. 50 | 26. 40 |
| May......... | 1, 521 60 | 25, 441 63 | 3 22 | 1 27 | 65 | 22 | 1 08 | 8, 441 63 | 7, 890 | 393. 50 | 100. 00 |
| June ....... | 1, 533 00 | 25, 394 28 | 2 88 | 1 17 | 85 | 27 | 59 | 5, 094 28 | 8, 800 | 419. 50 | 24. 00 |
| July ....... | 1, 864 64 | 31, 065 63 | 3 47 | 1 11 | 1 19 | 32 | 85 | 8, 065 63 | 8, 950 | 434. 00 | 24. 00 |
| August .... | 1, 807 40 | 30, 104 53 | 3 30 | 1 10 | 1 40 | 21 | 59 | 5, 104 53 | 9, 140 | 426. 00 | 21. 00 |
| September . | 1, 947 85 | 32, 683 14 | 3 74 | 1 03 | 96 | 31 | 1 44 | 12, 683 14 | 8, 730 | 400. 00 | 18. 00 |
| October .... | 1, 798 85 | 30, 173 43 | 3 41 | 88 | 1 22 | 04 | 1 27 | 11, 173 43 | 8, 855 | 401. 50 | 20. 00 |
| November.. | 1, 502 28 | 24, 857 21 | 2 86 | 94 | 1 36 | 12 | 68 | 5, 857 21 | 8, 700 | 414. 00 | 24 00 |
| December .. | 1, 567 25 | 26, 042 61 | 2 88 | 98 | 94 | 16 | 80 | 7, 242 61 | 9, 050 | 447. 50 | 20. 00 |
| Total. | 21, 246 72 | 355, 423 61 | ...... | ...... | ...... | ...... | ...... | 103, 323 61 | 104, 000 | 5, 031. 00 | 418. 44 |
| Average. | .......... | .......... | 3 42 | 1 11 | 1 00 | 31 | 1 00 | .......... | ........ | .......... | ...... |

Deadwood-Terra.—Previous to their consolidation the Deadwood mine paid dividends amounting to $275,000 and the Terra to $75,000. The dividend of 10 cents per share declared by the combination January 20, 1883, was the twenty-sixth to that date, making the total declared $889,000.

The production for the six months ending June 30, 1883, is reported to have been:

| | |
|---|---|
| Quarter ending March 31 | $121, 906 |
| Quarter ending June 30 | 84, 083 |
| Total | 205, 989 |
| July, 1883 | 39, 661 |
| Total seven months | 245, 650 |
| Average per month | 35, 093 |

Caledonia.—Present workings in the Caledonia are on the 400-foot level. The vein continues large, and on this level the ore becomes much softer, consequently the expense of mining is very materially reduced. Hoisting is done by means of a winze. This, however, will be abandoned as soon as the hoisting-cage shall have been sunk to the 400-foot level, when but one hoisting will be required, thereby effecting a further reduction of expense. A vein of ore encountered near these works yields $5 per ton, but is hard and flinty in character, necessitating an outlay of $1 per foot for drilling. At the shaft the angle at which the vein dips appears to be 32 degrees. High-grade silver ore was first discovered in this district in the North Star mine. It is a black sulphuret with occasional specimens of chloride, ruby, and native silver, and assays from 73 to 713 ounces. The deposit dips into the hill at an angle of about 3 degrees. The mine has been developed by an open cut for a distance of 175 feet and a tunnel 20 feet. The ore, of a high grade silver and gold but meager in the croppings where the rim of the deposit came to the surface, increased as this cut was extended until it reached a thickness of 5 feet.

*Carbonate Camp district.*—Ten miles northwest of Deadwood is Carbonate Camp, having for its southern boundary Squaw Creek and for the western Spearfish Creek. Its mineral basin is 8 miles long, 6 wide; formation, limestone traversed by dikes of porphyry. Dolomite in some places, at other times quartzite, forms the bed-rock. The ore carries from 20 to 60 per cent. of lead, is of a high grade, and runs from 60 to 3,000 ounces in silver.

It is claimed for the West Virginia that in it was first discovered the carbonate which gave the mining district the name by which it is known. The ore is a conglomerate of soft carbonate, decomposed lime, iron rock, and porphyry. This, in connection with the frequent occurrence of pockets and veins of a grade similar to that of those nearer the surface, it is believed, goes to show that the formation is out of place, and that its conglomerate character is the result of volcanic agitation. Fissures varying in width have been encountered by the several shafts and tunnels. The main ore, cut 100 feet below the surface by a tunnel in 175 feet, is reported as having been 20 feet wide.

In the High Lode extension, at the head of Gold Finch Gulch, the main tunnel has been driven 300 feet through bed-rock. Knowing the westward limit of the ore-body to be above the terminal of the tunnel, the management made an upward stope of 15 feet, which resulted in the discovery of a cement deposit, from point of contact with which a 30-foot ore chamber was extended 300 feet, through ore milling $4.87 per ton. Extra expense in working this mine has been occasioned by the fact that owing to the dip of the bed-rock the water which accumulates in it cannot be drained by gravitation, and therefore another tunnel has been started with a level 25 feet below that of the former, which will very much lessen the cost to deliver ore on the dump. Two tunnels, 300 feet each, have been run on the Gold Finch and several discovery shafts sunk, all of them in an ore-body much like the ore in the mine last mentioned, but of a higher grade. Five thousand tons have been extracted and milled, giving an average to the ton of over $6.

South of and adjoining the High Lode extension is the Golconda, developed by two tunnels, 368 and 210 feet in length, and a 30-foot shaft. From its dark, mottled-gray color the ore is said to resemble in general appearance that of the Caledonia. The shaft is in a body of rose-colored quartz and in driving the tunnels small fissure-veins have at times been cut, one 3 feet wide, 8 inches of it high grade. Specimens of free gold are said to be of frequent occurrence.

On Whitewood Creek is the Hartford Group, comprising the Only Chance, American Flag, Jumber, Hubble, and Peak. Work has been prosecuted with much assiduity and very encouraging results. One tunnel has been driven 214 feet, another, on a higher level, 165 feet. In cutting what was supposed to be the main lead a large fissure was shown, assays from which gave $14.15 per ton in gold.

Concerning Bear Gulch, situated in the northwestern part of the Black Hills, about 16 miles west of Deadwood, Mr. Mark R. Hydliff writes that the production of gold from the four districts—*Iron Creek*, *Potato Creek*, *Rawlins*, and *Hurricane*—which form it, was about $10,000, from the placer mines. The gulch extends from Iron Creek on the east to Hurricane on the west, about 6 miles.

Of the mines in *Rawlins district*, he says, the Giant lode has a 60-foot shaft and a 260-foot tunnel in rock that assays from $5 to $20 per ton; the Rough and Ready, a shaft of 40 feet; Little Lucy, one of 60 feet with a 20-foot cross-cut at bottom, and the Bertha, a shaft of 40 feet. The last named shows free gold.

On Mineral Hill, in Hurricane district, probably a dozen locations have been more or less developed, giving average assays of about $10 per ton in gold.

The Thunderbolt and Star of Empire also promise well, the ores being sulphurets carrying gold and silver. Assays from the latter mine have been as high as $240 to the ton.

*Bald Mountain district.*—On the eastern limit of Green Mountain is the Snow Storm, owned by the Milwaukee and Black Hills Gold and Silver Mining Company, chartered under the laws of Wisconsin in 1879. A wet-crushing 20-stamp mill was erected in 1880 less than a mile from the mine on Nevada Gulch. This was at once put in operation and a test run of 100 tons made that gave assays of $45 in gold and silver, the gold, however, exceeding the silver. The clean-up which followed this test run disclosed that not over 15 per cent. of the assay value had been saved, proving to the satisfaction of those immediately interested that no adequate appliances were then at hand for successful treatment of their ore, and that it must be dry-crushed, chloridized, and amalgamated by pan. Twenty-one tons were accordingly chloridized and amalgamated, and resulted in a bullion product of $745.08, or at the rate of $35.48 to the ton. The furnace in which the experiment was tried being unsuited for the purpose, further efforts were abandoned until furnaces of the required capacity can be procured and the mill remodeled and provided with double-delivery mortars for dry-crushing.

Another mining property belonging to the same company is the Elkhorn, also extensively developed, showing throughout veins of good grain quartz. Sample assays and mill tests have given $24 to $97 gold and some traces of silver.

Developments on the Buxton consist of two tunnels of 160 and 170 feet, respectively, and several shafts and open cuts. The formation to a depth of 40 feet is flat; below that, vertical. Sample assays show, gold $83.23, silver 30 ounces.

On Nevada Gulch is the Black Moor. Its ore-bodies are cased in sandstone, metamorphosed shale or porphyry, and assay all the way to $409 in gold and silver.

Operations on the several properties belonging to the Portland Consolidated Mining Company have resulted much more satisfactorily the past season. Now fully 70 per cent. of the assay value is saved, where formerly temporary suspensions were frequently occasioned by the excessive loss of gold, owing to the want of some suitable appliance that would more effectually save it. The value of the bullion product has ranged from $20 to $30, much of it $40 gold per ton, and from 8 to 20 ounces silver.

*Deadwood placers.*—There are in Deadwood Gulch a number of productive placer locations, which are stated to have yielded over $2,000,000 in gold. Among them is the Deadwood Hydraulic Company, which owns nine locations.

On Elk Creek, 8½ miles southeast of Deadwood, the Uncle Sam has erected a 25-stamp mill, and since the 15th of June has kept 15 stamps in constant operatio non ore which averaged about $10 per ton in gold. The mine is opened up by a shaft 150 feet deep and a tunnel running 80 feet on the vein and drifts of 80 feet each way on the 77-foot level. The ore for the mill was extracted from the lower workings and the yield during the year since starting up the new mill is estimated at from $20 to $30.

*Two-Bit Gulch district.*—This district, discovered in 1876, was so named from the amount of gold to a pan of dirt obtained in its early days. The entire gulch, 3 miles long, has been more or less prospected, most of it, however, below the road to Galena. As a rule the gold, though coarse, is fine in quality, and not infrequently nuggets are found of considerable size and value. The use of the hydraulic process has been discontinued, as the removal of the many large flat rocks encountered in working the gravel (done by hand) makes that process too expensive at the present price of labor. A good supply of water may usually be had until July; after that little more than a sluice-head is obtainable.

On the north bank of Two-Bit Gulch may be seen the Noble Grand mine, now the property of the Noble Grand Gold and Silver Mining Company. The two claims have in all five shafts sunk upon them, and two tunnels run, one 125 and the other 175 feet, with cross-cuts and ore chambers. A 25-stamp mill of the Homestake and De Smet pattern has been erected to drive the machinery of which a 40-horse-power engine is employed. Ore from these mines has given assays of from $11.35 to $60 to the ton.

Large sums of money have from time to time been expended on the Old Lexington. Its main shaft has a depth of 150 feet. There are three shafts, and all follow a rich vein of ore, some of it panning 80 cents per pound. Two tunnels also have been run, one of 50 and one of 112 feet, the latter tapping the main shaft on the 50-foot level. In some cases mill tests have given $17 per ton.

## PENNINGTON COUNTY.

Pennington, organized in 1877, is in the center of the Black Hills. That portion between the foot-hills and the Cheyenne River is well adapted both for agricultural and pastoral pursuits, while the remainder, about one-half of the county, may be said to be mineral bearing. Having their source in the Limestone Range, the backbone of the Black Hills, many streams of pure water flow into the Redwater and Belle Fourche Rivers on the west and into the Cheyenne on the east, and furnish in most seasons an ample supply.

*Palmer Gulch.*—The development of the Golden Summit mine consists of three shafts 60 feet deep and 300 feet apart. Dipping to the southeast its vein inclines to an angle of 45 degrees. Free gold of a fine quality has been taken out, and the ore runs $9 to the ton. A force of nine or ten men was employed during the season in development work, but the company's mill was idle, and no gold was shipped from the mine during the year.

The ore-body in the Grizzly Bear is composed of white quartz; its vein has the appearance of being an outcrop. The yield is reported as $10,000 in gold to 1,000 tons of ore.

South of the Grizzly Bear the Saint Elmo has kept a 5-stamp mill steadily employed during the summer, first using water, afterwards steam-power.

Four miles from Tigerville the Bengal Tiger has shown some very rich ore. Water has been troublesome in the mine and has compelled the management to run a tunnel to afford proper drainage.

*Rochford district.*—Between Silver and Gimlet Creeks, and 13 miles from Lead City, is the Minnesota. Located on the top of a high, unbroken ridge covered with a heavy outcrop of gold-bearing quartz, it is developed by a shaft of 165 feet, and 350 feet of tunnels and drifts, all in ore, with no indications of walls. At the depth of shaft further work was seen to be impracticable until hoisting machinery should be introduced. Three thousand tons of ore were removed while making these developments, and gave a yield of $4.54 per ton.

The Estrella Del Norte worked quite a force, at times as high as twenty-four men, with satisfactory results. The gold obtained is usually in small grains, the largest nugget taken out being worth only 90 cents. Machinery was procured for pumping water from the flume to the higher portions of the ore, by the aid of which it is expected that the product of gold will be increased.

The King Solomon suspended operations, owing its workmen for several months' wages. Suits were commenced by the latter and other creditors, and the personal property of the company was sold on execution. Mr. A. J. Simmonds contracted with the other owners to put up a 10-stamp mill with Blake crusher and concentrators, and to construct a tramway from the mill to Grizzly Gulch. The owners estimate that with this plant 2½ tons per day of clean oxide can be produced for shipment to smelting works.

The Stand-By's mill is the only one worked in the district, and is the only quartz mill in the Black Hills worked by water during the year.

The mills on the Alta, Evangelina, Charter Oak, and Minnesota were idle, owing to litigation and dissensions among the owners.

On North Rapid Creeks the Great West group of mines have been opened by a main tunnel 188 feet and a shaft sunk to the depth of 84 feet. Mill tests of the sampled ore are said to have averaged $6.75 per ton. The owners are said to believe that the ore is of sufficient richness to warrant the erection of a mill of 20-stamp capacity.

The following report upon the mines of Rochford district has been received from Mr. F. W. Bodunger, deputy United States surveyor, Pennington County:

"Mining has received a powerful impetus during the past year from the rich discoveries which have been made in this district as well of gold as copper and silver mines. Although no great amount of money has as yet been taken out, the discoveries have caused an influx of prospectors and capitalists, and have called attention to the wonderful riches of the whole district. Heretofore little attention was paid by prospectors to silver and copper mines, owing to the difficulty of assaying the same.

"The principal mines of that class in our district are the Homestake and New York mines, which contain silver-bearing galena quartz. They are situated in the immediate vicinity of the town of Rochford.

"The former, belonging to H. Struver, shows in a tunnel of over a 100 feet length a vein of considerable dimensions, and the latter, belonging to Fuller & Co., contains, as far as it is developed, a vein of exceedingly rich silver ore 4 feet wide.

"Six miles south of Rochford the copper and silver mine of Cushman & Co. is well developed and prospect high.

"About 8 miles from this place on Little Rapid Creek near where that creek breaks through the Limestone Range, Messrs. Bock, Buckholz & Green are working their silver and copper mines. They own several claims, the principal one being the Silver King, on which a shaft of over 100 feet depth has been sunk. They have a large quantity of rich ore on the dump, assaying as high as 80 per cent. copper besides a considerable amount of gold and silver. The owners are of the opinion that the ore will improve greatly in quality as depth is attained. They have applied for a patent.

"Besides those mentioned, there are many more or less developed. Most of them are superficial deposits in limestone, but they appear remarkably regular and well defined and very extensive. I cannot learn that any deposits '*in situ*' have not done well, although there are reports to that effect from discouraged miners.

"Since the summer of 1883 the Stand-By mine and mill have been steadily worked and given employment to a number of men. Since the beginning of 1884 the freezing of the flume necessitated a temporary suspension of work which, however, will be resumed as soon as the weather will permit. The exact production of gold could not be ascertained, but the superintendent expressed his perfect satisfaction with the result.

"The cluster of mines comprising the Great West, Great East, and Great North, near Goochville, were sold last summer to a representative of a Chicago firm who intends to erect a 20-stamp mill on Little Rapid Creek about 1,000 feet below the mines, to be run with water-power.

"The mines, especially the Great West, are well opened up and yield rich ore.

"The Minnesota mine, on Silver Creek, and the adjoining claims to the number of nearly a dozen have been bonded by a wealthy foreign company, the bond expiring in July, 1884, and hopes are entertained in well-informed circles that operations on a large scale will then be commenced.

"The leading mine near Meyersville, the Jennie Lind, has been steadily worked throughout the year by the owners. A tunnel was run from the east and the ledge was crossed at a depth of about 150 feet. The ore taken out has kept up the good reputation of the mine for richness and uniformity of yield.

"While the work on all the old claims is progressing, many new claims have been located and re-located, and as a rule our mining camp has a lively appearance.

"The placer mines on Castle Creek are still worked in a primitive manner. There are about a dozen of men engaged in placer mining on that gulch.

"The best paying mine is the Chipman Bar, which yielded about $2,000 during last year, all in coarse gold, Mr. Chipman working it himself."

## CUSTER COUNTY.

In *Custer district* the production of gold in 1883, from the placer mines Mr. D. Carrigan, of Custer City, informs me, has been the smallest known in its history; he places it at but $2,755.

The Penobscot is reported to have been run continuously during the year, and although doing a large amount of dead work in developing the mine, is stated to have more than met all the expenses from the clean-up.

Speaking of the production of the St. Elmo mine, which he reports as $2,590, Mr. Carrigan says it was the product of 90 days, using a 5-stamp mill run by water-power, each stamp weighing 350 pounds and crushing on an average 1½ tons per day. The mill was shut down in November on account of the inadequate supply of water, with the expectation, however, of starting again in March with steam-power.

The Battle Creek Gravel Company became involved, and their properties were sold on execution subject to one year's redemption.

# CHAPTER VI.

## IDAHO.

The production of gold and silver in Idaho during the past year has not varied materially from what it was in the preceding year, except that the value of the gold product has diminished slightly and the silver increased about the same amount.

The Oregon Short Line Railroad, which is in course of construction from a point some 150 miles east of Ogden to meet the extension of the Oregon system at a point on Burnt River just beyond the western boundary of Idaho, is now in running operation to a point about 80 miles west of Shoshone, in Alturas County, while a branch road has been constructed from Shoshone almost due north running through the heart of the Wood River country to Hailey, from which it is proposed to run narrow-gauge roads to the principal mining sections of that new and prosperous region.

This branch was completed too late in the summer of 1883 to have exerted any very great influence in affecting the production of that year; but it is beyond all question that the completion of these railroad systems will not only reduce the expense of transporting materials used in mining and milling ore, the cost of supplies necessary for subsistence, matters of great importance for the successful and profitable prosecution of mining industries, but also by affording more rapid and convenient means of communication will increase immigration and induce the investment of capital, and thus largely stimulate production. Some of these anticipated benefits have already been realized, but when sufficient time has elapsed for improved facilities in transportation and travel to have accomplished their full effect, it is not unreasonable to expect a largely increased yield of gold and silver from the mines of this Territory.

Glowing accounts have been published in the papers of this northwest country during the year of wonderful discoveries of both placer and quartz deposits in the extreme northwestern section of this Territory known as the Cœur d'Alene region, situated in the heart of the Cœur d'Alene Mountains, in the north of Shoshone County, in creeks tributary to the Cœur d'Alene River. Like all reports of a new country, they have generally been immensely exaggerated, but have had the usual effect of drawing to this far distant and almost inaccessible region several thousands of adventurous miners. An account of these discoveries is given under the head of "Shoshone County."

The total production of the Territory was, during 1883, about $3,500,000, of which $1,400,000 was gold and $2.100,000 silver. The yield by counties was approximately as follows:

| Counties. | Gold. | Silver. | Total. |
|---|---|---|---|
| Ada | $5, 000 | | $5, 000 |
| Alutras | 150, 000 | $930, 000 | 1, 080, 000 |
| Boise | 565, 000 | 40, 000 | 605, 000 |
| Cassia | 10, 000 | | 10, 000 |
| Custer | 200, 000 | 900, 000 | 1, 100, 000 |
| Idaho | 150, 000 | | 150, 000 |
| Lemhi | 100, 000 | 20, 000 | 120, 000 |
| Nez Perces | 12, 000 | | 12, 000 |
| Oneida | 8, 000 | | 8, 000 |
| Owyhee | 150, 000 | 200, 000 | 350, 000 |
| Shoshone | 50, 000 | | 50, 000 |
| Washington | | 10, 000 | 10, 000 |
| Total | 1, 400, 000 | 2, 100, 000 | 3, 500, 000 |

A portion of the information in relation to this Territory has been furnished by Mr. N. H. Camp, in charge of the assay office at Boise City.

## ADA COUNTY.

There are but few mines in this county. While some little gold is found in Boise River and its tributary creeks, it is not of sufficient value to warrant the projection of mining operations of any magnitude. There are some small placers on Snake River.

Meacham Bar, located about 8 miles above Henry's Ferry, is being worked in a very crude manner by packing the dirt to a rocker on the river bank, yielding about $4 per day per man.

The production of this county for the year 1883 was, gold, about $5,000.

## ALTURAS COUNTY.

The mining industries of this county have received considerable impulse during the year from the completion of the Wood River branch of the Oregon Short Line Railroad, running from Shoshone to Bellevue and Hailey. The completion of this branch, running into the very heart of the Wood River country, is of incalculable value to the mining industries.

The *Rocky Bar district* comprises a group of gold mines, most of them located on Idaho Hill, of which the Idaho and Vishnu are the most important. The Golden, Sierra, Wizard King, and Emmett, completing the list. About 175 men are employed about Rocky Bar, most of them miners.

The production of the Idaho and Vishnu mines, which are under one management, for the year 1883 was about $100,000.

In this district lies the Bonaparte mine, producing a very refractory ore. It is an old mine, having been worked since 1868, during which time it has produced about a half million dollars' worth of bullion. On the property is a 20-stamp mill, with the necessary reduction works, roasters, &c.

The Ada Elmore has been run on developments most of the year, producing about 75 tons of ore of an average value of from $60 to $75.

*Atlanta.*—The season of 1883 has been an unusually prosperous one for Atlanta. Two new mills, one of 10, and one of 20 stamps, were erected, several new prospects and mines opened, and much energy displayed in working old mines. Atlanta Hill, which is on the south side of the town of Atlanta, is the scene of the mining operation. Successive discoveries have proved the existence of a large mineral belt in this hill.

Upon the principal ledge, the Atlanta, extensive developments have been made by the Atlanta Mining Company, the Buffalo and Idaho Gold and Silver Mining Company, and the Buffalo and Atlanta Mining Company. The developments and improvements upon the remaining localities consist of prospect shafts and drifts, showing principally bodies of low-grade ores from $15 to $50 per ton.

The Monarch (or Atlanta) mine, which is the principal producer of bullion, completed its 20-stamp mill during the summer. The new hoisting works were put in operation about January 1, and three levels (100 feet apart) have been opened and connected by raises, &c. The present depth of the shaft is about 400 feet. This mine was discovered in 1864. The total yield of this mine since its opening is said to have been not far from $1,000,000.

The Buffalo mine, owned by the Buffalo and Idaho Gold and Silver Mining Company, has been continuously worked during the year, and is developed by a shaft 600 feet deep, opening 6 levels. The hoisting works, which had been under ground and were insufficient, are being replaced by new and more substantial ones on the surface. The company own a 10-stamp dry-crushing mill with roasting furnaces, in which they work their ore as well as custom ores. This mine according to reliable information has yielded over a half million dollars since its discovery.

The mines of the Buffalo and Atlanta Mining Company are developed by a tunnel 1,250 feet long, intersecting the Atlanta lode at a depth of about 1,000 feet, the lode being from 40 to 50 feet wide, with well-defined walls.

Almost parallel with the Atlantic lode, and intersecting the same near the line of the Monarch and Buffalo mines, runs the Pommery and Last Chance vein. The property is owned by a New York company and work thereon has been pushed during the last two years very energetically. The mine is opened by tunnels and a shaft 400 feet in depth connecting with the lowest tunnel. During the last season the mine supplied the company's 10-stamp mill near Atlanta with ore in excess of the mill's capacity. The ore assayed an average of $100 per ton, about 50 per cent. free gold, 20 to 30 per cent. sulphurets, balance silver. The company intend to erect a new mill, and have also made arrangements to sink a new three-compartment shaft with hoisting-works at a more suitable place. This mine is said to be one of the richest in the district.

The Tahoma lode, an old mine, located about 1 mile north of Atlanta, has passed under the control of a Boston company, which has erected a 20-stamp mill and has been working during the year. The ore consists of sulphurets, with ruby silver, reduced by roasting machinery on the ground.

Between the Atlanta and Tahoma lodes is situated the Big Lode mine (formerly called Leonora), owned by the Big Lode Mining Company of Boston. The company erected a 20-stamp mill in the fall of 1883, with all modern improvements, for the treatment of free gold milling ore, with concentrator attached to collect the sulphurets.

The Jessie Benton mine, owned by Messrs. Hale & Tinis, is situated about a half mile north of Atlanta lode. It is said to be a very fine property, opened by tunnels, drifts, &c., showing ore, bodies of high grade. It is claimed that 100 tons of this ore worked at the Buffalo mill last season were worth $123.53 per ton.

There are many good prospects too numerous to mention about Atlanta and surrounding hills, which have shown ores.

Placer mining is almost exclusively in the hands of Chinamen. The Atlanta bar, at the mouth of the Yuba River, yields from $3 to $5 per ton. The richer claims are owned by white men, but can be worked only a short time in spring. It is claimed that the production of this country during the last season would not fall short of 90,000 ounces of fine silver and 2,500 ounces of gold.

It is intended to build a wagon-road down the Boise River to make connection with the Oregon Short Line. When done it will add very largely to the mining industries of this country.

*Wood River country.*—This mining country, which is but in its infancy, promises to be one of the most remarkable in the United States. It was first opened to settlers in 1880, although it is said that mineral deposits were discovered there some seven years prior to that date. Heretofore it could be reached only by a long and tedious stage journey, but the completion last June by the Oregon Short Line of a branch road running from Shoshone through Bellevue to Hailey has brought cheap shipping facilities to the feet of the miners, and as the country is bountifully supplied by nature with wood and water, it bids fair to be one of the most successful mining regions not only in Idaho but the entire West.

The completion of the branch road referred to naturally added largely to the mining activity of this section. Owing to the late date of its completion, and the high rates charged for freight, production was not forced, but the value of the production for 1883 will be found very largely in excess of the prior years.

According to the Wood River Times, a paper published at Hailey, in this country the shipments from that point from May to the close of the year were as follows:

| Month. | Ore. | Bullion. |
|---|---|---|
| | *Car-loads.* | *Car-loads.* |
| May | 13 | 11 |
| June | 25 | 27 |
| July | 18 | 42 |
| August | 27 | 40 |
| September | 13 | 50 |
| October | 62 | 45 |
| November | 75 | 30 |
| December | 38 | 13 |
| Total | 271 | 258 |

Averaging a car-load at 15 tons, there was a total shipment in the last eight months of the year of nearly 8,000 tons of ore and bullion from Hailey. As to value, the base bullion is said to run about 300 ounces of silver to the ton, say $330, and lead $80, which would give the value of the bullion shipments during the period named at about $1,500,000. The value of the ore is placed at about $220 in silver and $56 lead per ton, a total value of over a million dollars. Value of ore and bullion over $2,500,000 including lead. These figures purport to be taken from the books of the Sampling Works and Philadelphia Smelter at Ketchum. The shipments in the prior part of the year were probably inconsiderable, as most of the shippers awaited the opening of the railroad.

The same paper states that the reducing capacity of this section has been increased from 150 to 595 tons per day, specifying as follows:

| | Tons. |
|---|---|
| Philadelphia Company (two furnaces) | 180 |
| Vienna mill | 30 |
| Sawtooth mill | 20 |
| Galena smelter | 30 |
| Hailey smelter | 10 |
| Mayflower smelter | 15 |
| Bullion jigs | 20 |
| Jay Gould jigs | 10 |
| Narrow Gauge jig | 10 |
| Idahoan jig | 20 |
| Hailey sampler | 250 |
| Total | 595 |

The Wood River Valley, said to be one of the smallest in the Territory, extends about 50 miles from north to south, and does not exceed 2 miles in width. The mineral region is said, however, to be from 20 to 30 miles in width and from 50 to 75 in length. As this is an extensive mining section, extending from the Sawtooth range of mountains on the north to the Snake River on the south, and taking in the country on both sides of Wood River, an account of its production and development will be best understood by reviewing it according to its natural divisions.

*Lower Wood River country, placer mining.*—This country lies in the extreme southeast of Alturas County and is bounded by the Snake River on the south, while the Little Wood River traverses it from north to south, emptying into Snake River. The sands of Snake River contain the finest quality of gold, the dust running from 920 to 965 fine, but it is also of so floury a nature that actual operations seldom show the assay value.

The geological character of the black sand, almost invariably indicating the presence of gold, shows it to have been deposited away back in the decades of centuries before, or about the time of the volcanic convulsions that formed the cañons along its banks. The character of the free gold accompanying the black-sand deposits is flat, minute, and scale-like, so much so, indeed, that any placer miner along Snake River will show his gold floating down his sluice-boxes, back into the river, and in such quantities that the profits of such mining have been in many instances reduced to a minimum. It has long been a problem with Snake River miners how to catch the fine gold.

Prominent among the machines invented for this purpose is one invented by Mr. Crane, of Washington, which may be briefly described as a "malaxator" placed in an upright position, with a stream of water running through it to facilitate the action. Another is the machine of Edwards Bros., of Blackfoot, which adds to the principle of the arrastra a stream of water running through at a low velocity; a third combines with the principle of the Crane machine a muller at the top, the action of which is intended to render the gold inclosed in the coating amenable to the action of quicksilver by forcibly breaking the coat so that at least one side of the grain may catch the mercury. None of these devices have, however, given the miner anywhere near the value per ton indicated by assay, although the results are more satisfactory than with sluice-boxes. It is believed that the problem may be solved by the use of such chemical reagents as will dissolve the coating on the grain of gold, as well as excite the quicksilver to increased activity.

Considerable capital has been employed in operations on this river during the year.

Work has been done during the year on the Hamburg claims, the Shoshone or Old Juniper claims owned by the Holyoke Company and situated about 2½ miles above the mouth of Raft River, at Bonanza Bar, about 16 miles below American Falls, and the Florence claims, about a mile above the mouth of Raft River. The profits have not been large. There are individual placer mines scattered along the banks of Snake River.

*Lower Wood River, lode mines*—Bellevue is the first important town, going north, in the Wood River country, on the new branch of the Oregon Short Line, and is located on the east side of Wood River. It is the center of a considerable mining activity.

About a mile from it, on the opposite side of the river, is located the Minnie Moore mine and hoisting and concentrating works, a full description of which was given in my report of last year. It is a well-developed lode, with an output of about 50 tons of ore a day, said to average about 100 ounces of silver and 60 per cent. lead. According to the Wood River Times of March 1, 1884, the preliminary arrangements of the sale and transfer of this property were filed for record in Hailey the previous day. The purchaser is said to be Cecil Brooke Palmer, of New York, and the price paid $500,000. The transfer of this property is considered a most important one for Wood River, as the real purchaser, Mr. Palmer, of the London firm of Dent, Palmer & Co., is one of the directors of the Bank of England, and it is thought will crowd developments as rapidly as possible.

The Queen of the Hills mine continues to look well. Eight men are employed on it sinking a winze, drifting, &c. It is reported that an ore-body 60 feet in length has been discovered. The Queen has lately made a shipment of 24 tons to the Ketchum Works.

The Big Camas mine, located on the west side of Wood River, south of the Bullion district, about 12 miles from Hailey, is reported to have struck a vein carrying $75 in gold and 13 ounces in silver to the ton. A tunnel has been run to the ledge and a shaft is being sunk to tap it. The shaft makes a good showing, and is 20 feet down, a solid quartz. The mine has a wonderful outcrop. The quartz, according to the Wood River Times, stands up in bold relief above the country rock 2 to 6 feet high and 26 to 60 wide. The quartz is said to be free milling, and can be worked by amalgamation in batteries and on copper or silver plates. Several prominent gold veins are said to exist in this locality.

Going north from Bellevue on the railroad a distance of only a few miles brings us to Hailey, the most important town in and county-seat of Alturas County. The town is principally important on account of being the terminus of the branch of the Oregon Short Line Railroad, and consequently the shipping point of nearly all the bullion and ore produced in this country. Hailey is a very thriving town, and it is thought that from it as a center branch roads will be built to the various large mining camps above and on either side of it.

*Bullion district.*—This district, situated a short distance west of Hailey, is known as the backbone of Wood River, and contains some of the best known and best producing mines in this county, viz, the Idahoan, Bullion, Mayflower, Jay Gould, Eureka, and O. K. About 350 miners are employed in the camp, apportioned as follows:

| | |
|---|---|
| At the Bullion | 180 |
| Mayflower | 60 |
| Idahoan | 25 |
| Jay Gould | 20 |
| Mountain View | 20 |
| Eureka | 10 |
| O. K. | 16 |
| Others | 19 |

At present nearly all the ore produced by these mines is shipped to Omaha for reduction, although a contract has been made by the Mayflower Company to ship a hundred or two tons to Salt Lake. The camp at Bullion is yielding about 50 tons of ore a day, which is brought to Hailey and shipped by rail to Salt Lake, Omaha, and Kansas City.

The Idahoan mine, of which a very full description was given in my last report, after a personal examination by Dr. Frederick Eckfeldt, one of my assistants, is still a large producer of good-grade ore.

The following account of its condition, taken from a communication dated December 19, 1883, from Judge A. P. Turner, the discoverer and resident manager of this mine, will be found interesting.

"Many extensive improvements have been made this year, having built a very fine mill for concentrating our second and third class ores, which has cost over $30,000, and contains a Doddridge crusher of 80 tons capacity, a set of Cornish rolls, five revolving screens, and four double-compartment jigs, also a double sye-box 3 feet in width by 12 in length; a fine stationary engine of 25 horse-power; a large ore-house above the whole works, so that the ore starts in above and continues on down through the whole course of machinery until it lands upon a platform ready for the wagons, to be hauled 3½ miles to railroad depot; have a ditch 800 feet long that carries 65 miner's inches of spring water that never freezes in coldest weather; a boarding-house 26 by 38 feet, one story, an office 14 by 25 feet, a blacksmith-shop, and coal-house. The mill building is 48 by 100 feet. We have an ore-dryer along the whole tier of jigs, that is heated by hot air from the dome of the boiler. We have all down-hill grade from the mine to the mill, a distance of 4,000 feet. Have built two large ore-houses at the mine, one at the mouth of the lower tunnel capacitated to hold 800 tons, and at the upper works, in addition to the ore already there, we have 8,000 feet of T-rail laid in and around the mine, having driven the lower tunnel westerly from the bottom of the shaft, a distance of nearly 600 feet, all the way on one vein of ore varying from 1½ to 14 feet solid galena. The upper tunnel is now driven nearly the same distance in the same direction. We have a winze from the lower tunnel to the surface a distance of over 400 feet, and all made in ore, except within 30 or 40 feet of the surface. The ledge fell over and cropped out some 50 feet south from where the upraise came to the surface. We sank 30 feet in ore from lower tunnel until water drove us out. This sinking was done in or near the face of the lower tunnel, making a depth of some 43 feet from the surface. We have an eastern drift from the bottom of the main shaft a distance of 75 feet, all the way in ore. We have a drift running northwest from the bottom of said shaft and across the formation a distance of 280 feet, striking what is known as Ironsides, a parallel vein to the Idahoan and supposed to be the Eureka vein that enters the side line of the Idahoan about 250 feet from northwest corner of Idahoan, and runs thence easterly by south a distance of over 1,250 feet, and passes out and across the east end of the Idahoan into the Iris.

"The Idahoan mine has been a self-supporting and constant-producing mine since its first opening. The last year (1883) it has put out over 3,000 tons of ore. Last November its output was 1,030 tons. This December will more than equal that of last November.

"The forepart of this season very little attention was paid to mining, as the dumps were full of second and third class ore and the accumulations of for two years' previous mining, besides quite a quantity of first-class ore, the product of the winter's development, amounting to over

400 tons. The grade of ore remains the same as two years previous. We have the advantage of a railroad within 3 or 4 miles, and all down grade to the depot."

The Bullion mine, located near the town of Bullion, a short distance west of the Idahoan, is the best-delveoped and richest mine in this region. It has nearly 6,000 feet in tunnels, drifts, and winzes, and has been explored to a depth of about 300 feet. The ore runs high, about $180 to the ton, and it is shipping about 10 tons a day. The mine belongs to the Wood River Gold and Silver Mining Company, and is in excellent condition. It has some 700 tons of second-class ore on the dump which will concentrate about 4 tons into one of first-class ore.

The Mayflower, owned by J. V. Farwell, of Chicago, is the second mine in the district, and a very valuable property. It is worked by two tunnels, 1,250 feet, in the upper tunnel on a continuous vein, from which 3 shafts are sunk, 100 feet each, to the lower tunnel, which is said to run 1,000 feet on a 36-inch vein. This mine is reported to have shipped over 900 tons of ore to Omaha since April 1, averaging about $180 in value. The steam-jigger at present turns out six tons of first-class ore daily and ledge matter to make a ton of first-class ore. At present it is shipping a car load (12 tons of ore) a day, and it is said has already more than paid its purchase price.

The Jay Gould, the next best producer of this district, immediately adjoining the Mayflower, is said to be looking better than ever, and according to a correspondent of the Wood River Times, who visited the section in August, 1883, had at that time some 3,000 tons of second-class ore on the dump ready to be worked by the new concentrator then in course of construction. The main tunnel is some 800 feet long, and cuts this vein at a depth of 700 feet perpendicular, or 900 feet on the pitch of the vein. Work is being carried on in a vein 6 feet wide having 4 feet of solid ore. At the end of the drift a winze is being sunk to connect with the Mayflower level on solid lead ore. The mine at present is yielding about 7 tons per day, worth about the same per ton as the Mayflower.

The Wood River Times, under date of August 29, 1883, states that a new body of ore had been cut into in the lower workings of this mine.

The Eureka mine, adjoining the Idahoan, has been worked during the past year, and is opening into a good paying property. The new concentration works are about finished. The mine is owned by Col. E. A. Wall and Colonel Shaughnessy. The shaft is down about 150 feet. The first level at 50 feet is run in 200 feet. The second level is in 150 feet. A level on the vein is in 570 feet in 2 to 6 feet of ore. A tunnel is now in 200 feet on the vein; starting from the surface, it runs on ore 10 inches to 2 feet wide. Forty tons of first-class ore were shipped this month, averaging 85 ounces silver and 60 per cent. lead. Three hundred tons of second-class ore are on the dump.

The O. K. mine, the next most important of the Bullion Group, has yielded quite a lot of high-grade ore, and is considered a paying and valuable property. It is being worked at about 300 feet and producing ore worth $125 per ton, and it is stated by correspondents who have visited it that it has a large amount in sight. The mine is well explored, and in every respect makes a satisfactory showing. The ore-body is strong and continuous, and a lot of 62 tons sold to the Philadelphia Company's smelter averaged 124 ounces silver and 71 per cent. lead.

There are many other claims and prospects in this section which have shown high-grade ore in paying quantities, notably the Bay State, Chicago, Parnell, Ada, Ellen Stilts, Mount View, Rising Sun, Saturn Group, Durango Group, Old Abe, and Point Lookout.

In the Point Lookout mine considerable work has been done. The mine is patented, and has yielded several tons of good ore. The shaft is down 60 feet, and it is said shows a width of 4 or 5 feet of second-class carbonate and galena ore which will go 130 ounces to the ton. In the tunnel, which is 150 feet lower than the shaft, solid ore a foot thick is reported, much of it gray copper. A half interest in the mine has been recently sold to New York capitalists.

It is reported that miners working in the Mount View mine struck the ledge early in January, 1884, and found it to carry a vein of galena from 1 to 2 feet thick, the ore being of the same character as the Bullion vein.

In the vicinity of Bullion is the Red Elephant group of mines. The property is not thoroughly opened, but it is said that a lot of 12 tons shipped to the sampling works recently assayed 100 ounces of silver and 60 per cent. lead to the ton.

It is reported that a strike has been made in the Star mine, in the Star Gulch, near Hailey, of rich galena, and 16 men have been put to work in the mine.

A few miles above the Bullion district are located the Deer Creek mines, situated near a small stream of the same name.

The Davitt mine, the principal one of the group, is being steadily worked; it is said to be a valuable producer. A new shaft has been sunk in it which is down 50 feet, and in ore all the way. The mine is not being pushed, and is only yielding about 1½ tons per day, which is taken out in doing development work.

The owners of the Davitt mine have recently acquired what is known as the Silver King mine, situated in Beaver Gulch, about 3 miles above Sawtooth, which is being rapidly developed, and the Imperial claim, on the south fork of Greenhorn Gulch, just above Deer Creek.

The Washington mine has developed into a valuable property. A number of men are at work on it, and are getting out ore for shipment. It is said to show a fine vein of rich galena.

The Narrow Gauges are working a number of men and constructing works for concentration.

On the Robert Emmett group the work of development recently started is under good headway, and some rich ore has been extracted.

The Montana group is doing well. A force of miners is kept steadily at work extracting ore, and the Snow-Fly, now well explored by 280 feet of tunnel, has shown up a fine ore body.

The Bullwhacker mine, another of the Deer Creek group, was discovered in the fall of 1882, but work was not commenced on it until April, 1883. A shaft is now down 50 feet, and shows a well-defined vein of solid galena, carbonates, and oxides varying from 6 to 28 inches in width. It is also reported that they have shown up a continuous ore vein or chimney from the shaft to a ravine 125 feet or more away, which has a width of from 4 to 15 inches, and that samples average 100 ounces of silver to the ton and 60 per cent. lead. Some 15 or 20 tons of ore have been extracted in development work and left on the dump, said to be the finest galena. This is a fine prospect, being located on the direct line of the Bullion mineral belt.

On Wood River, which runs almost due north and south, about 15 miles farther north, is situated Ketchum, a thriving little mining town, and the principal point of what is known as the Warm Springs district. Here are located the smelting works of the Philadelphia

Company, a brief description of which was given in my last report. There were smelted by this company from June 1 to December 15, 1883, 7,550 tons of ore, of which 2,380 tons were received from Hailey and 5,170 from the vicinity of Ketchum. The bullion product was valued at $960,000. The average of the ore shipped to them is said to have been 149 ounces in silver. These works, which were started as an experiment, are now an assured success. During the past two months they have received ores from over fifty mines, scattered all over Wood River section, and during the season of 1883, according to the Wood River Times, produced two hundred and thirteen car-loads of bullion. The shipments from Ketchum are reported as follows:

| Months. | Bullion. | Ore. |
|---|---|---|
| 1883. | *Pounds.* | *Pounds.* |
| May | 273, 500 | 386, 700 |
| June | 663, 800 | 677, 100 |
| July | 962, 400 | 520, 400 |
| August | 1, 136, 200 | 760, 200 |
| September | 1, 060, 300 | 344, 500 |
| October | 1, 098, 900 | 1, 893, 900 |
| Total | 5, 195, 100 | 4, 582, 800 |

There are various creeks tributary to Ketchum, each of which has its group of claims, more or less developed. They are Boulder, Eagle, Trail, Elkhorn, and East Fork on the east side of Wood River and Warm Springs, and Greenhorn on the west side.

Boulder sprang to the front last summer as a shipper, and created quite an excitement, not so much from amount shipped as the quantity exposed by very little work, and its high grade. On the Ophir a 50-foot tunnel run in on the ledge from the discovery shows in the bottom a continuous streak of galena and carbonates averaging 24 inches.

The Dora, Trapper, Yankee Blade, and Rebellion are all said to be good prospects.

A porphyry belt running from Boulder to Muldoon, about 30 miles, was found to contain gold-bearing quartz, but the discovery was made too late in the fall for any work to be done.

On Trail Creek, the assessment work on the Lavinia showed the ledge at 70 feet below the surface to hold its own. A winze has been sunk on the ledge, averaging 3 feet between the walls, the ore assaying from 30 to 120 ounces of silver and from 20 to 70 per cent. lead, but not found as yet in paying quantities. A winze 100 feet deep on the Alpine showed the ledge to be the same in character as the Lavinia.

Considerable work was done on the Mattie group, and a fine showing of gray copper and sulphurets was the result, assaying 300 to 1,200 ounces.

Elkhorn Gulch has been the main producer, and among its mines the Elkhorn stands first. Work is in progress on the ledge at the depth of 400 feet, and the drifts are showing up continuous ore bodies. In the workings above and to the southeast of the ledge, large bodies of ore are being extracted. The vein is now exposed 700 feet in length and 400 in depth with hardly a fault in it. Latest developments show it to be a contact between lime and slate. A tunnel is now being run to tap it at a depth of 600 feet. This mine is one of the most valuable properties in Idaho. It is producing at present about 12 tons of ore a day, averaging $150 in value, while new ore bodies are being continually discovered. Its production for the year 1883 is given by Mr. John

B. Hastings, United States deputy mineral surveyor at Ketchum, to whom I am indebted for much of the information in relation to the mines in the vicinity of Ketchum, as follows:

| | |
|---|---|
| Net cash received for ore from smelters | $179,841 |
| Expenses operating mine | 35,373 |
| Net profit | 144,468 |

The following statement from the Engineering and Mining Journal confirms the above:

"The expense of operating this property from December 7, 1882, to November 7, 1883, just eleven months, was as follows:

| | | |
|---|---|---|
| Labor, salaries, board | $24,536 | 23 |
| Incidentals, taxes, assaying, &c | 505 | 91 |
| Tools, iron, candles, &c | 2,480 | 72 |
| Hauling ore, &c | 5.102 | 18 |
| Timber for mine houses, &c | 2,595 | 29 |
| Incidentals | 152 | 00 |
| | 35,372 | 33 |
| Ore sold | 161,841 | 22 |
| Net profit | 126,467 | 99 |

"Besides this, 200 tons of ore have been delivered at the smelters, for which the company will receive $90.25 per ton, making about $18,000 to add to the net profits of the eleven months' operations."

The Noonday, also on the Elkhorn ledge and laying alongside, has exposed the vein for a distance of 150 feet and 300 feet in depth. A winze is now being sunk from the lower tunnel. At the bottom the vein is 3 feet thick with 1 foot of galena. In this tunnel, the car track is laid on 3 feet of galena, assaying 145 ounces of silver and 60 per cent. lead. A tunnel is being run to tap the mine 600 feet deep. Mr. Hastings reports the production of this mine for the year 1883 to have been 493 tons; value, $51,298; expenses, $19,398; net profit, $31,900.

The following description of this mine, written by a correspondent of the Wood River Times, and published in that paper, will be found interesting:

"The Noonday mine is situated 4 miles east of Ketchum, on Elkhorn Mountain, Elkhorn Creek. It is one of a rich group of fine paying mines in this vicinity. Tunnel No. 1, the highest up the hill, driven in perhaps 100 feet or more, with drifts run off to the right and left, exposes a fine large vein 6 to 8 feet wide of carbonate ore, soft and easily mined; no blasting is needed to mine it. The grade of this large body of carbonate ore is from 40 to 80 ounces silver, and from 20 to 50 per cent. lead, with fine bunches or pockets of very high grade galena, chlorides, and bromides mixed through it, that mill over 160 ounces silver and 50 per cent. lead per ton. The main body is fine concentrating ore, with large bodies in sight through all the workings, with about 2,000 tons on the dump. There are also several thousand pounds of high-grade ore sacked in the tunnel and drifts. This can all be made first-class ore by concentration, and save the expense of shipping waste. Tunnel No. 2 is in over 106 feet, and shows the same strong, continued vein of soft and hard carbonate ores as above. It also has side drifts run off to the right and left on the vein between the walls, with pockets of high-grade ore mixed in. The vein matter here is from 4 to 7 feet wide, and yields from 40 to 160 ounces silver and from 30 to 50 per cent. lead per ton. There are also hundreds of tons on the dump of this tunnel, and thousands of pounds of first-class ore sacked in the tunnel and drifts also. The timbering in the upper workings is not first class, as it was done by the locators for prospecting only, but that done by the company is of a better class. The vein in these two tunnels and drifts lies very flat, on a slight incline only; but in tunnel No. 3, after being driven in about 100 feet, the vein has straightened up considerably, and still holds its usual width, 4 to 9 feet between walls. In this there are drifts, shafts, and a winze, all of which show ore of both high and low grade (this is the lower workings and of course carries the highest and best ore). There is one spot over 40 feet long from which over 300 tons have been taken that milled over 160 ounces silver and 50 per cent. lead per ton, and the vein continues 8 and 9 feet wide of rich galena ore showing native silver.

"In the deep shaft, which is about 300 feet, the vein in the bottom is over 4 feet wide, well mixed with mineral. In the lower workings there are large bodies of talc in the vein, carrying high-grade ore. The hanging wall is slate, foot wall lime, with large bodies of ore all through the mine. Near the works is a large boarding-house and good accommodations for the men, and tons of high-grade ore are sacked all through the mine.

"The Noonday property comprises the Noonday, Juniata, and Badger mines, all in high-grade ore; easy of access by a beautiful wagon road, on which a team can carry 5 tons of ore on a wagon (12 miles) to Hailey, being a slight descent all the way from the mines. Only prospect work is being done this winter to open it for next season."

The Buckhorn has a ledge exposed 75 feet on its dip and 30 feet on its course. This claim lies alongside the Noonday, and the ledge is similar in character. The Badger and Juniata lie below the Elkhorn and Noonday. The ledge is exposed by tunnels, drifts, and shafts 700 feet in length and 150 in depth. The new Noonday tunnel will cut it 700 feet deep. Mr. Hastings gives the production of the Badger as $3,750, and of the Juniata 5 tons, netting $700.

The Parker, about 1 mile east of the Elkhorn, on the same ridge, was discovered in the spring of 1883, and is a white quartz ledge about 3 feet thick. From the discovery a tunnel was run on the ledge lying flat, and several ore bodies were encountered. At 100 feet the ledge turned and dipped into the hill at an angle of 55°. Sixty tons of ore have been taken out, and there remains a 48-inch face of it on all sides, assaying 150 ounces of silver and 65 per cent. lead. At present they are working twelve men.

The Star and Garter, on the opposite side of the creek from the Elkhorn, by some claimed as an extension, is developed by a tunnel cutting the ledge at a depth of 30 feet, lying between porphyry and slate and 17 feet thick; another tunnel to cut it 200 feet deep is being driven. The gangue is iron. As yet galena has not been found in paying quantities.

The E. C. Ray claim is supposed to be an extension of the Badger; a cross-cut is now being run.

One mile to the southeast of the Elkhorn, on a parallel spur, is the Baltimore group, discovered in the spring of 1883. A tunnel was run in on the ledge, lying flat, 90 feet; here it turned and dipped into the hill at an angle of 35°. In running 30 feet of tunnel and winzes $15,000 worth of ore was extracted.

The Victoria, an extension of the Baltimore, serves to open up the ledge for a distance of 700 feet. Four thousand dollars' worth of ore was extracted in running 200 feet of tunnel and drifting on the vein.

Assay value of the ore from 140 to 240 ounces of silver and 65 per cent. lead.

The Silver Bullion group was discovered in the spring of 1883, and consists of four claims, the Little Giant, Silver Bullion, Eulah, and Independence.

The Silver Bullion and Independence ledges are quartz in lime, the former 18 inches, the latter 48 inches thick. The former is opened up 125 feet on its course and 100 feet on its dip, with ore assaying 130 ounces silver and 55 per cent. lead; not found in paying quantities as yet. The latter is opened 200 feet on its course and 50 on its dip by a tunnel which passes through a chimney of ore 20 inches thick and 10 feet long, assaying 170 ounces silver and 65 per cent. lead. The production of the Independence is given as less than $300.

On the East Fork the North Star shows a ledge of black clay and spar and decomposed quartz. The shipments from the claim have been quite large. Mr. Hastings gives the production as 27 tons, of the value $3,650. About 100 tons of ore assaying 100 ounces of silver and 65 per cent. lead is said to be in sight.

The Southern Star has a well-defined ledge, about 36 inches thick, on which considerable development work has been done. There is a continuous ore streak, averaging 4 inches, which assays 50 ounces silver, 35 per cent. lead, and $35 worth of gold.

The Pride of Idaho, on the south branch of the East Fork of Wood River, is a very well-defined ledge of iron and quartz, about 18 inches thick, in lime, and is opened up by four tunnels run into the hill on the ledge, prospecting it 250 feet on its dip and 200 feet in length. The ore varies from carbonate, assaying 50 ounces, to galena, 250 ounces.

The iron mines of Mr. Chase have yielded large quantities of hematite for flux this season.

On Warm Spring Creek the principal producing mine is the Ontario, owned by the Warm Springs Consolidated Mining Company, of Boston. The vein is quartz, 3 feet thick; in several places for many feet galena takes its place. Four tunnels open it up for 300 feet on its dip and 250 feet on its course. One thousand tons of concentrating ore, assaying 25 ounces silver and 12 per cent. lead, lie on the dump awaiting handling. The production is given by Mr. Hastings as 496 tons; value, $67,440; net profit, $44,517.

The Black Horse has a well-defined ledge, similar in character to the Ontario. It has shipped about 150 tons, assaying 150 ounces silver and 65 per cent. lead, and has about 200 tons in sight.

The Ten Broeck (the Philadelphia Mining and Smelting Company owners) has a well-defined ledge of galena.

The Irvine, owned by the same company, is being thoroughly prospected. As may be judged by the shipments the ore bodies encountered were numerous and large, but as yet no well-defined ledge has been found.

The Poorman has a ledge 4 feet thick of zinc and iron, with galena, assaying 180 ounces silver and 65 per cent. lead; not found in paying quantities. It is opened up 250 feet in length and 100 feet on its dip.

The Mountain Girl has been prospected by a shaft to a depth of 100 feet. The ore, a galena containing sulphurets, assayed from 200 to 800 ounces silver. The ledge is regular and well defined, averaging about 12 inches thick.

The Olympia, owned by William P. Chandler & Co., of Boise, is opened up by two tunnels, exposing a well-defined ledge 100 feet on its dip and 200 feet in length, the showing being very good.

The Allen group, owned by William H. Stevens, Thomas W. Buzzo & Co., consists of five claims, on which are two veins, the upper exposed by a series of cuts, tunnels, and shafts for 1,500 feet; the lower by same means for 800 feet. From the junction they are traceable as one ledge for 1,500 feet. They lie in lime and vary from 6 to 60 inches in thickness. The galena in several places is from 10 to 24 inches thick, and the chutes thus exposed run for some considerable distance. The ore assays from 120 to 180 ounces silver and 65 per cent lead.

The West Fork group (owned by the Philadelphia Mining and Smelting Company) is leased, and the lessees are taking out considerable ore.

The Black Hawk has a well-defined ledge of iron, about 12 inches thick, developed by tunnels and shafts to a depth of 200 feet and 400 feet in length. Its recent work shows a streak of galena averaging 4 inches, assaying 180 ounces silver.

The Night Hawk, an extension of the Black Hawk, has a shaft on the ledge 100 feet deep. The east 15 feet is run through an ore-chute 8 inches thick of galena and carbonate, assaying 120 to 180 ounces silver and 65 per cent. lead.

Mr. Hastings states that, in addition to the mines the production of which is herewith mentioned, various other claims shipped 4,750 tons, the value of which at the same or even at half of the value of that mentioned would be $200,000.

The following summary (by John B. Hastings) shows the production for the year:

| | |
|---|---|
| Elkhorn | $179,841 |
| Noonday | 51,298 |
| Badger | 3,750 |
| Juniata | 700 |
| North Star | 3,650 |
| Ontario | 67,441 |
| Independence (1 ton sample) | 239 |
| Various claims, 4,750 tons. | |

The Columbia and Beaver mill, located at the little town of Sawtooth, on Beaver Creek, in the extreme northern part of Alturas County, did not commence work until late in September, 1883, but so far has had a very profitable season. The first consignment of bullion from the mill was received at Hailey early in October, and consisted of four bars weighing 226 pounds, and valued at over $3,000. As the mill was to work by the leaching process, grave doubts have been entertained as to its success, but since the shipment of bullion these doubts seem to be removed. The mill was run for only forty-five days, when cold weather required it to be closed for the winter, and during that time it is said to have turned out $60,000 worth of bullion.

There are about one hundred and fifty men at work in Beaver, Eureka, and Jake Gulches. Of this number, about fifty are employed on the Silver King (spoken of under Deer Creek mines as having recently been purchased by the owner of the Davitt). A large amount of ore is being extracted from this mine, it being the principal source of supply to the Columbia and Beaver mill. There is said to be a large ore body of high-grade ore in sight in both this and the Pilgrim, which is being worked by the same parties.

The Lucky Boy, in Jake's Gulch, is also yielding some 400-ounce ore. The vein is about 14 inches wide and regular. Only three men are, however, employed on it.

The Wire Silver, on the same vein, but higher up the hill, is looking fine. The shaft is down 100 feet and shows an ore streak from 2 to 6 inches wide. Two tons of this ore are on the dump, which, it is said, assays over $2,000 per ton.

The Comstock lies parallel with the preceding mine, about 300 feet above it. This shaft is down 130 feet in a vein 3 to 4 feet wide, which shows ore all the way to the bottom and assays from $300 to $400. About 3 tons are on the dump. Nine tons shipped to the Buffalo mill averaged 399 ounces of silver.

The Silver Bow is an extension of the Comstock. This lead crops out to an aveaage width of 8 feet and shows ore its entire length. The underground workings show the vein to be fully 12 feet wide and carrying black metal that runs from $700 to $900 per ton.

On the same vein is the Comet, which is proving a valuable property, a strong vein of rich ore having been found.

On the top of the same ridge, between Jake and Eureka Gulches, is located the Minnie Alta mine, and adjoining it are the Scotia and Eureka, the latter of which carries a rich streak of silver ore.

Very flattering reports are received from Vienna, a small but thriving town in the *Sawtooth district*, concerning the Mountain King mine. Heretofore the ores of that mine have not exceeded 20 ounces silver to the ton; but the vein is said to have improved and to show a width of a foot of ore which will run nearer 30 ounces. The production for 1883 is reported as 74 bars, valued at $103,600.

The Vienna mine, which for some years has been the mainstay and largest producer in Smiley Gulch, is still yielding steadily, and ore of even a better quality than formerly. The yield of this mine has been estimated to be $25,000 a month.

The Solace mine, one of a group of fifteen prospects, in the same gulch, owned by J. B. Haggin, of San Francisco, and others, is reported to be showing a fine body of rich ore, and it is said the company intend to erect a furnace mill to treat the ores. It produced no bullion during the year 1883, but has a large quantity on the dump.

*Little Wood River district.*—East of Wood River, about on a line with Hailey, the terminus of the branch railroad, is the town of Muldoon, the center of a new and promising mining region.

The principal mine of this region is the Muldoon. A force of fifteen men has been kept at work all winter on this mine doing development work, and it is reported that an upraise made in the ore body 40 feet high and 6 feet wide disclosed no end or walls. In running drifts, &c., some 400 tons of ore have been extracted which are now in the furnaces. The ore is of good grade, and it is said will carry 100 ounces of silver and 70 per cent. of lead. It is reported that a large quantity of ore is in sight, and that the supply is ample to keep the two 40-ton furnaces going. The production of this mine for the year 1883 is reported as: Gold, $678; silver, $33,792; total, $34,470.

*Smoky district.*—The reports from this region indicate increased activity in mining.

The Isabella mine is well prospected by shafts and drifts, and shows a vein 3 feet at the bottom of the shaft, 18 inches of which carries antimonial silver, and assays between 150 and 300 ounces.

The Philadelphia Company has employed twenty-five men to work on the Silver Star mine in making developments. The ore body is said to be strong, regular, and of a high grade. The principal cause of the slow development of Smoky properties is said to be the lack of productive work. The nearest route to a smelter is by way of Warm Springs Creek, a distance of 26 miles. There is no road, only a trail, and to deliver ore at the Philadelphia smelter cost $15 per ton.

As the ores run only 10 per cent. lead, the smelter charges $30 per ton for treating them, besides $27 per ton freight on the waste as well as on the bullion. The total expense of converting Smoky ores into money has been too great to pay the miners.

A new wagon road has been recently opened from Willow Creek and one is being built from the mines to Soldiers' Creek at Sampson's ranch, a distance of 12 miles. The ore mill at the mines was nearly finished in October, 1833. It has five stamps, and will be used to work the tailings from the concentrators, working the sulphurets and gold which is largely contained in the ore.

## BOISE COUNTY.

*The Banner district.*—The Elmira Company are sinking on the Banner mine, and are down about 70 feet from the main tunnel, which is 280 feet from the surface. They are sinking outside the vein to avoid water. It is intended to cross-cut the ledge when a depth of 300 feet is reached. The ledge is about 2 feet in width and contains silver glance, horn siver, and ruby silver. There is considerable water to contend with in working this mine, but the prospects are said to be very flattering. There is enough ore in sight to keep their mill running more than a year. The production during 1883 was about $105,000, consisting of 76 large and 6 small bars. The largest bar ever cast in the Territory was run by the company during the summer of 1883. The number of tons of ore run through its mill the past season was 1,024½, and from the amount in sight, if it proves as good in the bottom of the shaft as in the tunnel, it will prove a very valuable property.

The Panamint is located some distance southwest of the Banner, of which it is an extension. It is owned by James Irwin, Benjamin Miller, and Harvey Lester. Three tunnels have been run. The lower is in 175 feet. It will have to be extended 225 feet further to reach the vein, and it is estimated would tap it at the depth of 200 feet. The tunnel above this is in 240 feet. It tapped the ledge 100 feet from the mouth, and follows on the vein the remainder of the distance, 140 feet.

The vein where tapped is 2½ feet in width. After running a short distance the vein split, or rather another vein shot off toward the hanging wall. This vein is not so large as the other, but carries higher grade ore, the character being ruby silver. Between the two veins is a body of porphyry. After running a short distance on the foot-wall vein a cross-cut was run to the one carrying ruby silver. They have been at work the past two or three weeks running a cross-cut east, which is now in 30 feet, to tap the hanging-wall vein. The cross-cut commences at the face of the main tunnel, and will tap the vein by running a few feet farther. The ore is of the same character as that of the Banner, carrying ruby, black sulphurets, bromides, native and antimonial silver, and is richer than the Bannet was at the same depth. A tunnel has been run on the other side of the hill and 600 feet east of the last one mentioned. It was driven in 150 feet and cuts the ledge, which is at this point 30 feet between walls.

The Crown Point and Wolverine mines, the former of which was a few years ago a valuable producer, are still being worked, and have some good ore in the west end, but no permanent ledge as yet. In this end the main tunnel has been driven 40 feet, and a cross-cut 44 feet running north.

A correspondent writing from Banner to the Idaho World, under date of January 8, 1884, states this cuts a ledge 8 feet wide, carrying ore assaying all the way from $156 to $575 per ton, and that there is now more rock in sight than at any time since the company made its big run.

*Shaw's Mountain.*—Only assessment work has been done during 1883 on the mines in this district, the Rising Sun and Polar Star.

*Quartzburg.*—A report from Maj. R. G. Allen, agent of Wells, Fargo & Co.'s express at this point, gives the following information about the mines of this district: The principal mines are the Gold Hill, Yellow Jacket, Iowa, and Capital, which together have produced $76,799 during 1883. There have been no new discoveries. The ore is free milling and sulphurets, worked in stamp mills owned by the Gold Hill Gold and Silver Mining Company. The placer diggings are mostly worked out.

*Placerville district.*—Messrs. Myer & Smith, the agents of Wells, Fargo & Co., report the shipments of gold during the year from Placerville as $95,514.

*Idaho City.*—Mr. J. Moriarty, agent of Well, Fargo & Co., reports the value of the gold dust and bullion shipped during the year from this point as $381,550.

*Deadwood Basin* has produced during 1883 about 3,000, all from placer diggings, about one-half by Chinese. Several good quartz ledges have been discovered in this locality, which, however, have not been opened to any considerable extent. A mill has been started near Centerville, which produced during the year about $5,000, working on low-grade ores.

*Recapitulation of the production of Boise County,* 1883.

| | |
|---|---|
| Banner district | $105,000 |
| Quartzburg | 76,799 |
| Placerville | 95,514 |
| Idaho City | 381,550 |
| Deadwood Basin | 8,000 |
| Total | 666,863 |

## CASSIA COUNTY.

The following-named companies have from time to time worked placer mines on the south bank of Snake River, the character of the free gold found, however, being in minute, scale-like grains, and the difficulty of working the coated gold or black sand has prevented any satisfactory results, with some few exceptions, during 1883. The Detroit Placer Mining Company, about half a mile above Starr's Ferry; the Michigan. Placer Mining Company, adjoining the last-named company's property; the Vulcan Placer Mining Company, situated about 25 miles above the mouth of Goose Creek; the Excelsior Placer Mining Company, adjoining the Vulcan's Company; the Midas Gold Mining Company, about 8 miles above the Excelsior's property; the Boston Placer Mining Company, situated about 4 miles above the property of the Midas Company

## CUSTER COUNTY.

*Bayhorse district.*—Steady progress has been made in the development of this district, located in the eastern portion of the county. An important accession to its transportation facilities was made during the past year, Gilmer & Salisbury having established a fast-freight line via Ketchum and the Wood River branch of the Oregon Short Line Railroad. This is a great improvement over the old route across the mountains, via Challis and Blackfoot, on the Utah and Northern Railroad.

In the Florence mine development work has shown a 4-foot vein of fine galena and carbonates. The formation is lime and slate contact. The mines in the limestone belt have hitherto, from various causes, produced but a meager output of ore.

The Excelsior mine has been a large producer for two years, and has been sunk 100 feet on an incline of 60°; on this incline was run three levels in the ore body from 20 to 30 feet each. The ore is of good quality, running on an average from 60 to 80 ounces silver and 30 to 40 per cent. lead. The production of this mine from May 1 to December 31, 1883, was about 100 tons, averaging 75 ounces silver and 35 per cent. lead, silver value, say, $8,000. There are now in the ore-house and tunnel nearly 200 tons of first-class ore.

The Beardsley mine, adjoining the Excelsior on the same hill, is worked by an incline and tunnel similar to the Excelsior, and is considered a fine property.

The Ramshorn group, located on a mountain of the same name, in the slate belt, consists of the Ramshorn, Skylark, Silver Wing, Bull of the Woods, Utah Boy, Post Boy, Pugilist, and Cuta mines. The first mentioned employs nearly one hundred men, the Wing forty, Skylark about as many, and the Bull about a dozen.

The Ramshorn is about 4 miles from Bayhorse. The character of the ore in this as well as nearly all the mines of that section is galena, gray copper, and native silver. Some of it runs very high, assaying 3,000 ounces to the ton. Four tunnels have tapped this ledge. The face of the lower is 1,400 feet deep. The next level to be run will tap the vein 300 or 400 feet deeper. The ores of this district pay well.

*Yankee Fork district.*—The following information in relation to the mines of this section, furnished by a correspondent of the Salt Lake Tribune, gives an excellent account of the mines of this region.

"Bonanza is the center of the Yankee Fork mining country, where once there was much activity in placer mining, and later in prospecting for quartz leads and opening them up. With the discoveries and consequent excitement in the Wood River country this locality became much neglected for a time, and Bonanza and the country around has had but little life the last three years. We believe the time will soon come when there will be numerous good mines here, and the district will be a large producer of bullion. A few properties are being worked, and of these we give a few facts, commencing with the well-known—

Charles Dickens.—This is the best mine in the district, and is owned by William A. Norton. There are 2,300 feet of tunneling. The main tunnel is in 950 feet, and a shaft 120 feet connecting the upper with the lower tunnel. The ore is free-milling gold and silver, the vein averaging from 1½ to 6 feet, and runs from the top of the ledge down; 500 tons of first-class ore will be milled the coming month at the Custer Mill; over 300 tons are sacked and ready for shipment, which will average $200 a ton. About $4,800 in gold bullion has been shipped this season, the work of the arrastra from low-grade ore. The arrastra works 2 tons daily. There are 8,000 tons of second-class ore on the dump, averaging $50 a ton. Last season 30 tons of first-class ore was shipped to Salt Lake, averaging $860 per ton. The mine never looked better, some of the ore assaying $4,000, some going as high as $25,000 a ton. The only thing needed is a good stamp mill to work the ores. The mine is easily worked and there are immense quantities of ore in sight.

Juliette, the eastern extension of the Charles Dickens, owned by William A. Norton, R. C. Chambers, and William G. Galigher, has just started working with six men. The shaft is down 20 feet and the vein 5 feet wide, the ore averaging 100 to 400 ounces silver and 15 per cent. gold. This property will be incorporated in Salt Lake shortly.

Dan O'Connell is situated on Dicken's Hill, parallel with the Charles Dickens claim, and is owned by John Carroll. Several tunnels are run on the vein. The vein is 3 to 5 feet, going $200 to $1,000. Considerable ore on the dump.

The Pilot, at the west end of Dickens Hill, is owned by Johnson Brothers and others. The vein is 4 or 5 feet. The tunnel is in 46 feet, with the same class of ore as the Dickens. Over 50 tons of ore on the dump.

Paradise group, comprising the following mines: Paradise, Washington, Fair Play, Passover, owned by John G. Morrison. This group is situated west of the Pilot, and is an extension of the Dickens ledge. There is a tunnel in 75 feet on the Washington. The main tunnel in the Paradise is 200 feet, having some very rich ore.

Mr. Morrison is working a placer claim on Jordan Creek, and is getting out some coarse nuggets going $50 to $100 each. He is ground-sluicing and hydraulicking, uncovering the ledge of the Paradise group, where he will be apt to find some rich ore adjacent to the ground where the largest nuggets were found. The claim is very rich and paying well, and he is not only making good money out of his placer diggings, but is also developing his quartz claim.

Montana, situated in Yankee Fork mining district, is at the head of Jordan Creek, 6 six miles from Bonanza City. This valuable property is owned by D. B. Varney, D. Cameron, Amos Franklin, James Hooper, and J. W. Faulkner. It has a shaft down 350 feet, tunnel run in on level 185 feet. The vein in the shaft is 8 feet wide. The ore, averaging $150, is free-milling gold and silver, gold predominating. The mine is shipping 350 tons of ore to the General Custer mill, which will be worked by the 1st of August. Forty tons worked this spring at the mill averaged over $600. Ther mine improves the more it is prospected, and at the present time is looking well.

Whales, owned by James Hooper and Galatian Brothers, is situated 1 mile west of the Montana. The ore croppings are traced for over 800 feet. The vein is 8 to 15 inches, going $300 to $2,000 per ton. It is looking well and will prove to be a good property.

The General Custer mill is 2 miles north from Bonanza City, and has thirty stamps, run by 118 horse-power Harris-Corliss engine; three 54-inch boilers, 16 feet long; eight pans, and four settlers. The General Custer mine and Unknown are owned by the same company. The mill was built in 1880, and has been working on General Custer ore continually up to the present, but is now clearing up and will start working ore from the Unknown. The bullion has averaged over $60,000 monthly; 35 tons of ore were worked every twenty-four hours. The mill employs thirty-two and the mines thirty-six men. The mill this season has worked custom ores from the Montana, Charles Dickens, and Badgers, and will work ten stamps on Montana and Charles Dickens ore the coming month.

## LEMHI COUNTY.

I am indebted to Mr. Charles J. Barclay, of Gibbonsville, for most of he information in relation to the condition and production of the mines f this county.

*Gibbonsville.*—The mines here were discovered in September, 1877, and during the fall one arrastra was built and started, but, owing to the want of experience in managing it, but little gold was obtained until 1878, when two more arrastras were built and successfully operated, those who had the experience imparting it to the others. All made successes, and from that time on the camp became self-supporting. The veins here are *true fissures* in character, cutting the country rock at nearly right angles. The character of country rock is slate, with occasional layers of quartzite, pitching generally to the east. There is a porphyry dike extending clear through the district, and all the producing mines lie to the east of it, though the veins are more productive after they cut into the porphyry, not even bunches of good ore being found in it. The veins are generally small, and, as nearly all veins of like character, uneven; *i. e.*, the ore occurs in chutes, those chutes generally continuing, as far as developed, downwards; at least I know of none that ever gave out, and they show no indications of so doing. On the contrary, they appear to get larger as depth is attained. No great depth has as yet been reached, as the ore becomes base at various depths as water-level is reached, and there being no proper facilities for working the ore, it was the policy for miners dependent upon the production of gold from their mines to keep as near the surface as possible, the ore there being oxidized and the gold free, while, after water-level is reached, the ore is iron sulphide, some white, some yellow, some coarse cubes; in other cases fine as steel, but all kinds carrying from $50 to several hundred dollars by assay per ton. The average yield of all the ore worked by arrastras is somewhere from $20 to $30 per ton of 2,000 pounds, and at least one-third of the gold contained in the ore was lost, owing to its refractory nature when being treated by simple amalgamation.

Efforts have been made to work the tailings, and a partial success attained, by roasting and amalgamation, but it was found that the roasting set the gold free, but a great part of it would not amalgamate, and was so fine and light that it would not even settle, so that was lost. In June, 1881, a large portion of the producing mines was sold to an English company, and afterwards incorporated in London as the Idaho Gold Mining Company, Limited; but, owing to misrepresentation and other causes, the company went into liquidation and sold the mines to General Adelbert Ames, of New York, who now owns them.

The affairs of the old company were in great confusion, everything having been attached for debt. Therefore General Ames has only had time to make a test of two orthree hundred tons, which it is understood was entirely satisfactory. He has let three contracts to drive levels lower than any formerly driven, intending to develop the mines, ascertain the quantity and quality of the ore, and erect suitable plant for the proper working when he knows what is required.

The Esmeralda mine has been idle for two years owing to bonds and other detentions, but it was started last October, and a run made of 26 tons that yielded in pure gold $750 and about 8 tons of concentrates valued at $50 per ton, or a total of $1,150. Then the mine was leased till July 1st and work is being vigorously prosecuted, the contractors having driven a raise up to the upper level, 75 feet, and secured perfect ventilation, and the owner is engaged driving a cross-cut to open up another portion of the mine as yet unexplored. He expects to cut the vein 30 or 50 feet from the winze at 150 feet. Nearly all the distance the main level has been stoped out, except where the lessees are at work on middle vein, and about 75 feet on front vein. The cross-cut now being driven is for the back vein, there being three veins in the location, which will probably unite as depth is attained. The front and middle veins on upper level are 35 feet apart, on lower level 75 feet deeper. The distance has decreased to 22 feet, and indications show that they will approach more rapidly. The middle vein now pitches toward the front vein. The experiments in working sulphurets have all been conducted by the owner of this mine, and the total yield of gold has been about $20,000.

The William Edwards mine has had a good deal of development work done on it, two levels run and connected by winze. The mine has been worked more to develop it and ascertain its value than for profit, no stoping of any consequence having been done. The ore is quite base and does not yield well by free milling process, though assays of over $900 per ton has been obtained.

The Etna mine has also been leased for a time and work is being vigorously prosecuted. A tunnel was run and the vein cut, but the ore is base at present; they are driving for a chute that is known to be freer.

That includes all the mines being worked at present, though there are many more good mines that are idle on account of the baseness of the ore. The facilities for economically working mines are unequaled, the best of yellow pine timber for lumber and red fir for mining timbers being abundant and water-power everywhere. The mines are situated on steep hills so depth can be gotten without very long tunnels, and ore extracted cheaply.

*Mineral Hill.*—About 20 miles below the mouth of the North Fork of Salmon River there is a new mining camp called Mineral Hill.

On the north side of Salmon River, and only a short distance from the river, is what is called the Grunter Lode. It is cut by a gulch exposing the vein for three or four hundred feet on each side, and on the east side of the gulch there is no hanging wall, it having all slid off; therefore the vein is bare for about 300 feet square. It varies from 3 to 20 feet in thickness and some ore worked in an arrastra yielded about $20 per ton. Here the top ore is free, but only the top, as all the cuts in the vein show base ore, about the same as at Gibbonsville, with the difference that there is a little galena in spots. On this mine there is being erected a ten-stamp mill, the intention being to work off the top ore as far as it will pay, and then put up concentrators and the necessary machinery for properly working the ore. As yet, no amount of money has been taken out, the ice in the river carried away the water wheel.

On this lode are a number of locations, the Lost Miner being first on the west, then the Clara, the Black Bear, and the Kentuck. This last mine has been bought by Gilmore and Saulsbury *et al.*, and work has been prosecuted to a limited extent for over a year, mostly explorative. A tunnel has been run and the lode cut and they are now driving levels. Several shipments of the ore have been made and the result has been very good. The first ore of ten tons worked $198 per ton, and others were quite as good. The vein is large, but, as the other, base as soon as a depth of a few feet is reached. A one-stamp mill was put up and a few tons run before it froze up last December, which, it is said, paid $90 a ton. They also put up two arrastra beds, but did not get them into operation until too late. For the amount of work this camp shows well, and promises to be one of the great producers.

*Pine Creek.*—About 2 miles south, and on the other side of Salmon River, there is another camp, called Pine Creek. There are some locations, but no developments to speak of, though some of the ore prospects well, and there is a good chance for some good mines when sufficient work has been done. A sort of an arrastra was built, and as high as $80 realized from a small vein, but the ore was too hard to get. Other ores were tested, but I am unable to give results.

*Moose Creek.*—About 15 or 20 miles southeast of Pine Creek, and 8 miles east of Leesburg Mining Camp, there is a camp called Moose Creek. This is one of the best, if not the best, placer mine in the Territory. It belongs to David McNutt. This mine is worked by hydraulic power. An iron pipe, 30 inches in diameter, leads the water to the distributors. Two giants are used, 8-inch nozzles, under something more than 100-feet head. The mine is on a large flat, clear of timber and underbrush, and about 12 feet in depth. The pay seems to be about the same wherever it has been worked, probably $12,000 or $15,000 to the acre. Last season about 7 acres were cleared off. The dump is a dry gulch, leading into Salmon River, and having a fall of at least 2,000 feet in 5 miles. So it carries everything to the river, and can never fill, no matter how much *débris* is emptied into it. The exact amount realized last year is not told, but it will be safe to put it at $75,000. There is plenty of ground to last for many years to come, and the prospect is that it will pay much better as it is worked, drifting having been done in various places with good results; but continued working by that process would not pay, The water season is short, and that is the only drawback to the property.

At the upper end of the above-mentioned claim is a 5-stamp gold mill belonging to the Shoo Fly mine. This mine was discovered by William Wallace in 1870. On sitting down to rest on one of the enormous quartz bowlders he commenced pounding it and exposed the gold. He leased the mine to a man, who put up an arrastra and worked the ore up to $36 per ton, losing a large proportion at the same time. Mr. Wallace then erected a 5-stamp mill, and worked the float rock, som of the bowlders yielding over 30 tons. He then sank on the lode, but the water was very troublesome and but little headway was made. Fred. Phillips, of Salmon City, having purchased half of the mine, is now running it, and has run a tunnel, drained the mine, put in an engine to drive the mill, and a new mortar, and is pushing the work in a workmanlike manner, with excellent results. Though the new mortar is too short for five stamps, and only four are run, it takes three teams to keep the mill in employment, each team making two trips daily, hauling from two to three tons each load. This vein is large, and the ore is easily crushed, though there is a large percentage of loss, the tailings assaying over $20 per ton.

There is a group of mines directly east of this, carrying some good ore, but as yet they are only prospects, no money having been realized. Some tunneling and shaft sinking have been done and fair prospects obtained, but it would be impossible to say what they amount to yet.

*Leesburg.*—Eight miles west of the Shoo Fly mine is the old placer camp—Leesburg. A large amount of gold dust has been taken and is still being taken from the placer mines, though the principal mining is now being carried on by three companies by means of bed-rock flumes. A few Chinamen are scratching around, all helping to swell the total, but it would be hard to find what the actual output was, without making that a special matter of inquiry. There are a few quite promising quartz prospects, but no developments of any consequence.

About 12 miles below Salmon City is a group of mines known as the

Freeman and California. They are nearly on the summit of the Rocky Mountain range. They were bought a few years ago by a company, and some work done, but since that time nothing but assessment work has been done, no reduction works put up, and all the ore extracted lies on the dumps. There is one very fine chute of ore about 3 feet wide and considerably over 100 feet in length, which ought to yield at least $20 per ton, by free milling process, in gold. None of the mines mentioned carry any silver to speak of; therefore when the value of ore is given it means gold.

About 12 miles up Lemhi from Salmon City is a mine called the Eldorado. A New York company, associated with some parties in Salmon, bought the property and erected a very fine 20-stamp steam mill and tramway. They tried the Eldorado ore, but could not make it pay. They then opened the Ranger mine, and found the ore in it rich enough, but they thought it too small to pay, so work was suspended until 1882, when it was again started up, but owing to the business failure of the principal owners work was again stopped, and so it remains at present.

These mines are also situated near the summit of the Rocky Mountain range, and at an altitude of 10,000 feet, and for 8 miles southerly the same vein crops out at intervals—in one place at least 80 feet wide—though at that place nearly or quite barren; but in many places there is good ore, and carrying a good percentage of silver. In one place, where there is a location called the Bailey lode, there is an ore-chute that assays high in silver, carrying about the same quantity of gold as the Ranger—from $25 to $35 per ton.

The time is not far distant when all these mines will be looked after. Only those rich enough to be profitably worked in arrastras have been in request so far, but that will not always be the case. The whole range is full of mineral, and all that is wanted is energy and capital to make it yield.

*Summary of production during the year* 1883.

DAHLONEGA DISTRICT.

| | Gold. | | Gold. |
|---|---|---|---|
| Esmeralda | $750 | Golden Circle Group | $5,000 |
| Etna | 4,000 | | |
| William Edwards | 300 | Total | 10,050 |

TEXAS DISTRICT.

| | Silver. | | Silver. |
|---|---|---|---|
| Jumbo | *$210 | Carry Cady | $85 |
| McClellan | *210 | Lincoln | 45 |
| Alexander Stevens | 220 | Rebecca | 60 |
| Red Wing | 180 | Ella | 110 |
| George Ainsley | 230 | Mollie Goobs | 140 |
| Latest Out | 100 | Midnight Belle No. 1 | 45 |
| Montezuma | 110 | Keystone | 45 |
| Star of the East | 140 | Dixie | 90 |
| Emma Bond | 170 | Miller | 35 |
| Maryland | 230 | Last Term | 80 |
| Silver Moon | 200 | Democrat | 70 |
| Annie Percell | 240 | Pocahontas | 110 |
| Whale | 110 | Lily of the West | 55 |
| Muldoon | 50 | Mohawk | 55 |
| Midnight Belle | 60 | | |
| Silver Lake | 110 | Total | 3,595 |

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* Of this amount $10 was gold.

## ONEIDA COUNTY.

The only mining in this county consists of placer workings along Snake River.

*Eagle Rock district.*—The gold production of this district for the year is reported as follows: W. H. Edward, & Co., $4,972; Chamberlin, $560; total, $5,532.

## OWYHEE COUNTY.

This county, located in the extreme southwestern border of the Territory, was the scene of the first mining in Idaho, and is still a valuable producer of both gold and silver.

*Reynolds Creek district.*—On Delmonico Bar, along Snake River, are the placer mines of Mr. H. S. Cheasbro, taking water from Reynolds Creek through a ditch 4 miles long. As this creek dries up in July, the working season is short. The yield will average from $5 to $8 per day per man. The production in 1883 was about $1,500.

*Florida Mountain.*—The Empire State mine has continued to extract a good quality of ore. The ledge has been worked by a force of from eight to ten men and the lode holds its average width with good ore in the bottom of the shaft and drift. The ore-house is said to contain considerable ore. The surface water has given the mine much trouble during the year.

The Black Jack mine continues to yield good milling ore. Twenty-five men are employed taking out quartz and opening up the mine. The ore is hauled to Leonard's mill for reduction.

The Seventy-Nine mine, immediately north of the Booneville, is being worked under a lease, and has extracted about 60 tons of ore, which has been milled and yielded satisfactory returns. The lode is from 3 to 15 feet wide, of low-grade ore, intermixed here and there with rich rock.

The Starlight, owned by Pete Brannan, is opening up well. The owners have sunk a shaft on a large ledge, the ore from which will mill well.

The Dardanelles is being worked at the head of Jacob's Gulch on Florida Mountain. The shaft is sunk 40 feet, and the ledge is said to be about 20 feet wide.

The drift on the Leviathan is continued, great depth being attained upon the ledge as the drift is driven north. Fair milling ore has been placed on the dump.

*Wagontown.*—This mining camp is situated about 7 miles almost due west from Silver City, and contains some valuable mines and ledges; while the ore is low grade, there are some veins carrying quartz that will yield from $50 to $70 per ton. The ledges are said to be large and well defined.

Among those now being worked in this district is the Garfield, situated on the ridge that runs down by Gordon's sawmill. It is not known how wide this ledge is, but it is large enough to keep the two mills in this district running constantly on good ore. The lode is situated on the side of the hill almost northwest from the Webfoot mine. No great amount of work has been done on it, but enough to show a good ore body. The lode is tapped at a depth of 30 feet. Some drifting has been done upon the lode, which at this point is about 25 feet wide. The ore requires roasting and all the appliances for reducing base ores.

The Webfoot mine is admirably situated for working, being on the ridge or back bone of a hill and could be cross-cut with a tunnel at great depth. The ledge is about 6 feet wide and well defined, and will yield an immense quantity of low-grade ore. With a few miners a twenty-stamp mill could be kept running the year round on ore from this mine.

Following up the ridge, we come to the Kent lode, which is a ledge about 3 feet wide, carrying ore that will assay from $10 to $100. The rock is called gold bearing. Continuing on our course we come to the Crown Point mine, owned by W. F. Summercamp, which is a ledge from 3 to 6 feet wide and assaying from $10 to $50 per ton. The ore is similar to the Kent.

The Idaho situated below the Saint Clair ledge, contains a fine quality of quartz. The ledge is about 2 feet in width in porphyry formation (as are all the mines in this district), and assays about $60 per ton. The bullion obtained from this mine is principally gold, which renders the lode more valuable, in view of the fact that the ore from it can be worked cheaply and the mineral saved.

The Last Chance lode, situated south of the Webfoot, is about the same size and quality.

The Stoddard is situated half a mile east of Saint Clair ledge, overlooking the road from Wagontown to Silver City. The ledge in the bottom of the drift is 4 feet wide and contains good ore, some of a high grade. It averages about $47 to a ton. The ore may be said to be free-milling, quite a pile of which is now on the dump. The lode is well located for working, being situated on the side of the hill, into which a tunnel could be run that would strike the ledge about 750 feet deep.

The Zulu, owned by Frank Lepley, is producing free-milling ore worth from $40 to $50 a ton. There are many good prospects in this section, such as the Ohio and Wilson.

*War Eagle Mountain.*—Work on the War Eagle mine, which was suspended on account of water interfering, and afterwards because of litigation, was resumed during the year and much good ore extracted. One hundred and thirty-five tons of it were milled at Sands's mill which yielded $50 per ton, and plenty more of the same rock was said to be in the mine. The mine makes much water and is consequently being developed only on the upper levels.

The Whisky Mine is producing fine ore. The ledge is not very large but quite rich.

The drift on the Ruth is being driven south and is now about 700 feet. It will be continued until it strikes good ore.

The Idlewild, owned and run by E. A. Thompson, is turning out fine ore. The ledge is about 18 inches wide with well-defined walls. This is one of the oldest and best mines in the camp.

The lessees of the Stormy Hill mine now have about 100 tons of ore on the dump. The ore runs about $75 to the ton. The ledge is large and so easily worked that two men have extracted the above amount in thirteen months.

The owners of the Red Jacket have completed the erection of the hoisting works on the mine and are now extracting rich ore. As work progresses the ore improves in quality and it is thought that a chute of very rich ore exists ahead of them.

Surface water has impeded work on the South Chariot Mountain. As it was turning out rich ore at the time the miners were driven out, it is thought that work will soon be resumed.

The lessees of the Minnesota are working the mine and taking out good milling ore. The water will not allow work to any great depth, and as a consequence they are working in the upper stopes. This was once a rich mine and it is thought to still contain ore in paying quantities.

The Dungannon, owned by Bruce & Donahue, is showing up good ore, gold bearing, and of a kind easily milled. The ledge is large and well defined.

The Webster, situated about midway between the War Eagle and Minnesota, near the San Juan ledge, has about 70 tons of first-class milling ore on the dump, much of which contains rich gold-bearing quartz. The ledge has been thoroughly prospected on the surface for over 500 feet, showing good ore the entire distance, averaging $60 per ton.

During the winter of 1882 a shaft was sunk on the vein for a depth of 70 feet, and drifts run each way from the bottom for a distance of 30 feet. Surface water has given the miners great trouble.

The Elizabeth, the north extension of the War Eagle, leased by Phillips, Miller & Co., has sunk a shaft of about 60 feet, and drifted on the lode, which is large and contains free milling ore. The lessees have recently encountered what they think to be a chute of pay-rock in the drift, which will mill better than any ore yet found in the mine. About 80 tons of it are now on the dump. The ore is free milling, gold predominating, and can be worked cheaply.

The Miller mine, situated northeast of the Elizabeth, continues to yield a good quality of ore.

The Lucky Poorman, owned by Vinton & Cook, is situated west of the last-named ledge, and development work is progressing on it. From specimens recently taken from the mine it is thought that they have reached a rich ore body.

The Hawes Brothers are extracting a fine quality of ore from the Lady Washington. They claim to have found a true fissure of free-milling ore, which will yield not less than $100 per ton.

More or less work has been done during the year on the General Wolseley, Piute, Belle Peck, Polar Star, Pauper, Owyhee, Bannock, San Juan, Glen Brook, Little Laura, and the Silver Monarch, but none of them have been large producers.

*Flint district.*—This district lies about 10 miles south of Silver City, and is connected with it by a good wagon road, which is open at least six months of the year. It is also accessible at all seasons of the year by a more southern road, making the distance from Silver City to Flint about 25 miles. Since the advent of the Oregon Short Line, however, a shorter and more direct route is available, by which the mines are only 65 miles from a station on the railroad.

The ores of this section consist principally of antimonites of silver, black sulphurets with a sprinkling of ruby silver, thus making roasting and chlorination absolutely necessary. Chlorides are to be found in spots and whenever found prove exceedingly rich, assaying all the way from $10 to $20,000 per ton.

The topography of this country is such as to make mining a very easy matter. The sinking of shafts is unnecessary at present because tunnels can be run in on the ledges, thus draining the mines of the superfluous water always found in a granite formation. Timber is plentiful, and easily accessible, and water amply sufficient for milling purposes. All the ledges appear to be of the same character, running almost due north and south. They invariably lie in granite, with sometimes a cap of almost indestructible dark (almost black) rock of apparently volcanic origin. No cross ledge has ever been found. As the ledge matter is very hard and flinty, though easily worked, thus making the timbering of the mines unnecessary, the working of even the small ledges will be an easy and profitable matter. The pay-streak that is the ore body of the highest grade invariably lies near the hanging wall sulphurets and antimonites.

The Rising Star is one of the earliest discoveries. It is being opened very quietly and steadily, and will in a very short time make a big showing. It is situated on the west side of the Denny lode about 600 feet. The lode crops out several feet above the ground, showing a ledge from 6 to 10 feet wide. At this point a shaft has been sunk to a depth of 300 feet. The ore on the dump will mill $20 to $60 per ton. A cross-cut has been run to tap the lode. From this about 20 tons of ore have been taken, which is said to run over $100 a ton. Following the cross-cut for 60 feet brings one to the ledge at the old shaft. The drift runs alongside of it for some distance, and it is at this point that the rich ore body is said to lie.

The Star of the Evening, supposed to be an extension of the Rising Star, and owned by H. S. Cheasbro, of Boisé, is located in the south hillside of Twilight Gulch, and is a magnificent ledge of from 4 to 8 feet in width, with ores assaying from $25 to $2,500 per ton, and certainly averaging $125 per ton. The working facilities are excellent, as the ledge runs through a gulch up two steep hill-sides, thus affording the very best locations for tunnels and dumps. The ledge matter is very hard and flinty, but nevertheless is readily worked. The lode has been opened for about 100 feet, showing a ledge 6 feet wide, with fine ore. On the east side of the ledge there is a very rich stratum coming into the main lode about 1 foot wide, carrying sulphurets and chloride of silver.

West of the Star of the Evening, and not 600 feet distant, runs the Rising Sun, a very neat ledge of 2 feet in width, with ore assaying $150 per ton. A tunnel about 50 feet long has been run north and south on the ledge, fully demonstrating its value.

Between these two locations a small ledge, called the Polar Star, has been discovered, and though only 14 inches wide its value has been fully established. No location, however, has been recorded on this ledge since the distance between the Star of the Evening and the Rising Sun is less than 600 feet, thus throwing the Polar Star into one or the other of these locations.

The Venus runs 1,200 feet east of the Star of the Evening. Samples of ore taken from the hanging and foot walls of the shaft from top to bottom show an average value of $458 per ton. The ledge is from 18 inches to 2 feet wide, but has high-grade ore distributed all through the ledge matter from wall to wall. A shaft has been sunk to the depth of 60 feet near the summit of the ridge, and one near the central point of the location, showing a very fine deposit of ore.

Less than 600 feet east of the Venus (which was called the Pioneer by its original locator) runs the Garfield, formerly known as the Forest. This is a very prominent ledge of nearly 4 feet in width, with an immense ore body, assays from which, it is safe to say, will average $120 to the ton. On this ledge and near the summit of the ridge a shaft has been sunk 100 feet, showing the same condition of the vein and the same character of ore, thus fully proving the value of the ledge.

The Eclipse and Unknown are two small ledges between the Venus and the Garfield, and about 14 and 12 inches, respectively, in width.

The Helen mine, which is the first south extension of the Rising Star, has a ledge which stands up between the walls 6 feet in width, containing quartz, not rich, but of good grain. Northeast from this is the Boyd & Keller lode, owned by F. T. Douglass. The ledge has been uncovered, but no work of any consequence has been done on it. The ledge is about 2½ feet wide.

The South Side lode, immediately west of the last named, contains a ledge 3 feet wide of high-grade ore. Several cuts have been made in it, all of which have encountered pay ore. A double shaft has been sunk to the east of this lode to a depth of 60 feet, which is in good condition, except containing some water. Ore from this lode is said to have milled $200 per ton.

Following the line of this lode for a distance of about 1,000 feet in a northerly direction lies the old Paul Keller, now owned by James Denny. It contains a ledge 3 feet wide with two walls and plenty of good ore on the dump. The ledge in the bottom of the shaft shows a fine quality of ore for the entire width.

At the Perseverance are two shafts about 100 feet apart, one 65 and the other 30 feet deep. Both shafts contain good ore, which is rich in silver. A visitor in April, 1883, reported 150 tons of waste quartz on the dump that will mill $60 to the ton.

The South Side shows a fine ore body, and though but little work has been done has several tons of ore on the dump.

The Mount Diable, an extension of the latter, has some fine milling ore on the dump. The ledge is about 3 feet wide.

The Black Warrior, supposed to be a continuation of the latter, has shown up some exceedingly rich ore. Like all the others of this district most of the ore is base, and has to be roasted before amalgamating.

The Astor property has been worked for the past fifteen years. It has a drift run on the ridge which is of good size, and supposed to be a continuation of the Rising Star.

*Mammoth district.*—This district lies about 10 miles due south of Silver and about 4 miles east of Flint. The principal ore body is the Anuga (formerly known as the Mammoth). Here is a large ledge cropping out of the ground for many feet and of great width, much of the ore being of a good character and suitable for milling. The vertical shaft is sunk east of the lode. From the bottom of the shaft a cross-cut has been run which taps the ledge at a depth of 92 feet, which at this point is over 15 feet wide, and assays from $5 to $75 per ton. The ledge is well situated for working, there being an excellent mill site about half a mile from the lode, where water power can be obtained nearly all the season. Wood is plentiful in the neighborhood and the facilities are splendid for working this Mammoth ledge.

## SHOSHONE COUNTY.

*Cœur D'Alene mines.*—In the extreme northwestern part of Idaho, in Kootenai County, lies the little town of Cœur D'Alene, a military post of the United States, located on a lake fed by a river of the same name. From this point the Cœur D'Alene River flows due east, crossing Shoshone County almost its entire upper width. On this river are located the placer deposits of which so much has been said and written during the past year. The reports concerning them are very conflicting. By some they are described a perfect "bonanza," while other accounts go so far the other way as to say that "there is no known paying ground there." From the most reliable accounts it is safe to say that both of these statements are far wide of the actual facts. But one thing is certain, that the find of gold along the Cœur D'Alene River has produced great excitement in the northwestern country, and thousands of men have braved all the hardships and dangers of the roughest of journeys in the hope of finding fortunes in this unknown eldorado. The "find" was first discovered in 1882, although it is said that the adventurous miner had set foot in this wild and mountainous section prior to that time.

The diggings are situated in Shoshone County, just across the border line of Kootenai, about 75 miles southeast of Rathdrum, the principal railroad point in Northwestern Idaho. It is a very mountainous and badly-broken country, and is reached by wagon road from Rathdrum to Fort Cœur D'Alene; thence by the Mullan road to what is known as Evolution; thence over a mountain trail to Beaver, Eagle, and Pritchard Creeks. The latter part is said to be a terrible journey. The only means of transportation is by Indian ponies and pack trains, and a correspondent describing his journey says, "To reach this point (the upper fork of the Cœur D'Alene River) the river had to be forded twenty-five times, and the water was so high that the animals had to swim at every crossing. During the whole journey we were in fine timber—mammoth pine, cedar, tamarack, and cottonwood trees, as large as 6 and 7 feet thick, and from 100 to 200 feet high, and all these as close together as trees can grow, almost as thick as wheat sown in a field. The timber is so dense that should a man get a quarter of a mile from the trail he would be lost, for the underbrush and the fallen timber is from 6 to 8 feet deep."

Pritchard Creek, where the rich placer deposits were first discovered, and at present the principal scene of the mining operations of this region, is a stream about 25 miles long and one-fourth of a mile wide. It is flat and smooth, having a fall of 2 feet to the hundred, with a gradual and even slope. The gulch is covered with timber, and there is plenty of water. Ten miles of this gulch have been prospected and valuable pay dirt found. The bed rock is slate, and is said to be very rich, paying from 1 to 2 ounces of gold per pan. There are a few inches of pay gravel on the bed rock. It has not been ascertained as yet how wide the pay-streak is, but parties are now working in the center and both sides of the gulch with good success.

The Widow's claim, 6 miles above Eagle City (a little mining town which has been located on Pritchard Creek), pays from $12 to $20 per day per man.

McCumber's claim, also those of George Ives and Dr. Slocum, on this creek, are paying finely. On all these claims and many others work is progressing.

Drainage ditches are being cut and sluices are being placed in position.

There are several gulches tributary to Pritchard's which have all been taken up—Eagle Creek, about 7 miles long; Butte Gulch, 3½ miles; Gold Run, 2 to 3 miles; Quartz Gulch, 4 or 5 miles long, and Beaver Creek.

Very little has been done by way of development on Eagle Creek, yet the prospects obtained show beyond a doubt that gold in paying quantities exists along its bed.

The gold found thus far is coarse, unworn gold, with some quartz attached. Most of it has been found in crevices and between the layers of the vein of the bed rock. The gold is said to run $16 to the ton. Placer diggings have also been discovered on Beaver Creek. As these creeks are from 10 to 20 miles long, it will be readily seen that this placer district is an extensive one.

*Free gold quartz.*—The mining excitement of this section is not confined to placers, as rich quartz deposits have been found to exist, and though little but development work has been done on them, owing probably to the less expensive and more profitable placer mining, yet enough work has been done to show that it exists in paying quantities along both Pritchard and Eagle Creeks, and many quartz ledges have been located.

The immediate occasion of this "find" was a valuable gold lode at the head of Pritchard Creek. The vein has been traced on the surface for a distance of 900 feet, and the croppings are prominent. The ore taken from the vein shows a large amount of free gold plainly discernible to the naked eye.

Coy and Friend have a free-gold quartz claim on Pritchard Creek. At the point opened the vein is strong, 3 feet wide, the walls being well defined and from indications a true fissure vein. The croppings are prominent, and the lode is easily traceable on the surface for 800 feet. Some very fine chunks have been taken out, and the quartz when broken would actually hang together by threads of gold. Although but little development work has been done, and it is hard to form a sound opinion as to the real value of the strike, it appears to carry a pay-streak about 1 foot wide.

Tom Irvin has a gold vein near Miners' cabin on which a great deal of development work has been done during the past four years. The vein is from 18 to 24 inches wide. A shaft has been driven down on the ore body to the depth of 80 feet, and in the bottom the vein is 20 inches wide. The ore gives from $28 to $196 per ton gold, the former being the smallest assay reported.

The parent lode, 5 miles above, on the same creek, is a large deposit of free milling ore. The vein is fully 10 feet wide, and averages across its entire width $40 per ton in gold. But little work has been done on it yet. The present outlook is for a good paying property. Several other fine claims have been located on the lode.

Near the head of Beaver Creek prospectors have located a number of claims of galena, immediately on the croppings, which can be followed on the surface a long distance. The lodes all tend in a northwest and southwest course, and are very regular, pitching almost regularly into the mountains. At many points the veins have been stripped for hundreds of feet, and everywhere shows a remarkably high percentage not only in silver and lead, but also in gold. The outcrop in some places measures 60 feet in width. The first claim struck on the galena belt is called the "Big Bug," and the vein can be traced nearly 500 feet on the surface, and for the entire distance carries very high in each of the metals mentioned. An average of several tests made by Portland assayers returned $39 gold, 60 ounces of silver, and 46 per cent. of lead per ton. This claim is 1,500 long by 600 wide. The Big Bug is situated on the divide between Granite and Beaver Creeks.

Silver Tip is the best-developed mine on the belt. A shaft was sunk to the depth of 10 feet, and it is said that the vein at the bottom carries ore averaging $326 gold, $46 silver, and 72 per cent. lead to the ton. The vein has been stripped on the surface for several hundred feet. Several other leads have been opened, all of which promise well. The production of gold from the placer mines of this county for the year 1883 is reported as $79,500.

## WASHINGTON COUNTY.

*Washington district.*—This district, generally known as "Mineral" district, is located about 30 miles north of Miser City, its center mineral city being on a creek tributary to the Snake River.

The Black Maria is the most celebrated of the mines of this district. The incline is down 110 feet, with several tunnels and cross-cuts. It is owned by Boggs & Landy, and is considered a very valuable property.

The Black Hawk is near the above. It is a black hill on which are located the Black Warrior, Black Sam, and Black Prince, all said to be good properties. Across the creek is a huge mountain, in which the Daniel Boone is situated. This mine has been thoroughly prospected by several shafts and tunnels, and it is reported that recently the owners struck a fine ore body.

Work is being done on the True Blue, Kit Carson, Nevada, and Jolly Traveler. Some rock taken recently from the former showed up well. Some good mines are also located on Wolf Creek, in this district. The Sunnyside and Highland, owned by McEachern; the Maud S., owned by Henry and Emery Boggs; Greenhorn, owned by Ed. Holcombe; Homestake (formerly the Ben. Butler), all present a good appearance through shafts and tunnels. Blasting for a tunnel has been done on the Portage mine, on the south side of the divide, between this creek and Bennett's. This mine has a good reputation.

Considerable work has been done on other claims on the north side of this divide, the best showing at present being the Mountain Rose.

*Heath district.*—About 20 miles north of Mineral is the Heath district. Of its mines the Belmont has been successfully worked during the year with a 2-stamp mill. The ores are chlorides of silver.

# CHAPTER VII.

## MONTANA.

The general review of the mines of Montana was prepared by Mr. R. E. Preston, of my office, who was placed in charge of the revision and arrangement of the material relating to the production of the Territory. Mr. R. B. Harrison, in charge of the Helena assay office, as heretofore, collected and forwarded a large amount of valuable information, which has been embodied with that received from other sources. It was found necessary to reduce the estimated production as stated by correspondents both in regard to individual mines and to the aggregate for several counties.

During the year 1883 Montana produced in gold $1,800,000, and in silver $6,000,000, making the total production of the precious metals in that Territory $7,800,000. The production of gold decreased from $2,550,000 in 1882 to $1,800,000 in 1883, a loss of $750,000. while the production of silver increased from $4,370,000 in 1882 to $6,000,000 in 1883, an increase of $1,630,000. The increase in the silver production of 1882 was due principally to Silver Bow County, in which are located the most prominent mining districts in the Territory, and is at present one of the most productive in the United States. The increase was over $1,600,000. Previous to 1876, what is now known as the Butte district was regarded merely as a placer camp, but lode claims date almost as early as the placer discoveries of Silver Bow Creek. Butte district is now chiefly known for the silver and copper that it yields, the great veins traversing the district, though there is still a large area of placerground which was profitably worked during the season of 1883. The ground for some distance along Silver Bow Creek is said to be rich in placer gold, but the flatness of the creek makes it impracticable to conduct a drain or tail race, as a ditch 2 miles long would not gain enough in depth to make the fall sufficient to render sluicing profitable. The rock inclosing the veins in this district is granite; that in close proximity to the veins is usually decomposed. The veins are nearly all confined to perfect walls, with selvages of clay of various degrees of tenuity, and vary in thickness from 1 to 40 feet and upwards; the vein matter is quartz, combined in the silver mines with manganese and iron, in the copper mines with iron in various forms. The copper veins are indicated by an outcrop of quartz and the brown oxides of iron with a slight trace of manganese, while the silver veins are indicated by quartz, black with the oxide of manganese, sometimes spots of iron oxides, but the manganese predominates.

Among the principal veins of the district are the Mountain View, Saint Lawrence, Anaconda, Parrot, Original, Gagnon, and Colusa. At the west end of these veins the percentage of copper decreases, gradually merging apparently into silver veins, with which they are bordered on the west. When the croppings of these veins, are found near the surface, on the higher elevations, copper is only found in spots of carbonate, but the veins nearly always contain silver in sufficient quantity to be worked with a small profit.

Below the croppings, down to the point where the water-line is struck, little copper exists, while below the water-line they are rich at intervals and might be called copper mines. The silver found above the water-line is in the form of chloride, and is reduced by the ordinary process of milling and amalgamation without chlorination. Below the water-line copper appears as a sulphide pyrites to rich copper glance. The silver is nearly always found in seams as leaf silver or thin scales, with occasionally spots of sulphurets. There are two distinct classes of veins in this district: first is a continuous compact vein, the second a mass; the extent of the masses in latter is valuable, being in some instances from 200 to 300 feet long and quite as deep, while others are limited. On both ledges the masses are thin, but in the center quite thick. The masses of ore are confined to certain zones, traversing the district, having well-defined walls, and the whole may properly be denominated a rim. There is still another system of veins, consisting of a series of gashes seemingly in the granite, and often containing ore of good quality, and while at intervals they show indications of permanence, yet they are still uncertain. The character of the ore will not guarantee large dividends, but there are many mines in the district, if properly developed and managed with economy, that would pay interest and fair dividends upon the capital invested.

The leading mines of the district are opened by vertical shafts and the ore raised on cages. The hoisting machinery is generally set in granite foundations and is of the most approved pattern This speaks well for the intelligence of those to whom the work of development has been intrusted. Since the first discovery of gold and silver in Montana it is estimated that the mines have produced nearly $180,000,000, principally gold. Placer as well as quartz mining is still carried on in various sections of the Territory.

The following are among the mines that paid dividends in 1883:

| Name of mine. | Dividends. | Amount. |
|---|---|---|
| Boston and Montana | 1 | $10,000 |
| Hecla Consolidated | 12 | 180,000 |
| Hope | 3 | 67,824 |
| Lexington | 1 | 220,000 |
| Original | 12 | 36,000 |
| Total | 39 | 513,824 |

There is every reason for believing that the future of Montana is a bright one, and that it will for years to come hold a leading position in the production of the precious metals.

Development in the mineral resources of Montana during the year 1883 is in a great measure due to the completion of the Northern Pacific Railroad, traversing the entire length of the Territory, affording means of communication with the centers of trade, the need of which has been severely felt ever since the organization of the Territory. By the introduction of cheap freight a market for the commodities is no longer inaccessible, and supplies of all kinds can now be readily obtained. The effect has been an influx of capital and an increase in all branches of business, as well as a rapid growth in the population of the Territory. The first train out of Helena bound east over the Northern Pacific Railroad (July 4, 1883) carried over 1,000,000 pounds of base bullion, stated as the half-yearly product of one mine. Bullion, ores, and cattle have formed a large portion of the freight of two railroads, and branch lines are being constructed over various sections of the Territory; the two systems making connection at Garrison, a point on the Northern Pacific and the northern terminus of the Utah and Northern Railroad.

In 1880 the population of Montana was less than 40,000; during the last three years, from the most reliable estimates, it has increased to over 80,000, and during 1883 the increase is stated to have been about 10,000, although the Northern Pacific Railroad was not in systematic running order in Montana until the latter part of the year.

Mining has been and will continue to be for a long time a productive and leading industry. The activity and development in this interest in 1883 have found a decided impetus in the greater facilities at command for the shipment of ores, while the acquisition of means for their treatment has been made a possibility to distant and heretofore inaccessible districts, and mines that heretofore could not be worked on account of the low-grade ore can now be worked at a profit, owing to the cheaper rates at which supplies can be obtained and low freight charges on bullion.

I estimate the production of the precious metals in Montana during the calendar year 1883 to have been $1,800,000 in gold and $6,000,000 in silver, distributed by counties as follows:

| Counties. | Gold. | Silver. | Total. |
|---|---|---|---|
| Beaverhead | $75, 000 | $705, 000 | $780, 000 |
| Custer | 10, 000 | ............ | 10, 000 |
| Deer Lodge | 450, 000 | 600, 000 | 1, 050, 000 |
| Gallatin | 35, 000 | 5, 000 | 40, 000 |
| Jefferson | 340, 000 | 100, 000 | 440, 000 |
| Lewis and Clarke | 250, 000 | 50, 000 | 300, 000 |
| Madison | 240, 000 | 20, 000 | 260, 000 |
| Meagher | 60, 000 | 20, 000 | 80, 000 |
| Missoula | 40, 000 | ............ | 40, 000 |
| Silver Bow | 300, 000 | 4, 500, 000 | 4, 800, 000 |
| Total | 1, 800, 000 | 6, 000, 000 | 7, 800, 000 |

## BEAVERHEAD COUNTY.

This county contains the oldest mining districts in the Territory. It was here that the first discoveries were made of silver-bearing quartz and the first smelter in the Territory was erected. Its mines have been steady producers, though the lack of reduction works and mills in most of the districts has prevented as large an output of bullion as might otherwise have been expected. During the year just closed the operations in many of the mines have been confined principally to their more extended and deeper development, but the total production of gold and silver has been somewhat in excess over that of 1882.

The *Argenta district* contains many rich mines and locations that only await development to make them valuable. This is an old and productive camp that is still flourishing, and indications point to an output largely increased during the coming season. The ore taken out has been similar to that extracted in the past, which long ago established the fact that Argenta smelting ores of average grade were equal in the number of ounces of silver to the ton to those of any other camp in Montana. Operations have been pushed with vigor, and, besides the large quantities of ore shipped to Salt Lake City and elsewhere, there is much good ore remaining on the dumps, of which every ton will pay.

The sale of the Argenta placer diggings, owned by Messrs. Kelly, Ravenscroft, and Scott, has been made to a company of London, England, capitalists. It is understood that the consideration paid was

$20,000. It is expected the English company will open the diggings with a bed-rock flume, and work with hydraulic pressure and little giants.

*Bannack district* has also shipped considerable ore south and east. The 6-stamp mill, situated on Grasshopper Creek, has been kept fully supplied with ore. A large amount of free milling ore has been opened up in Bannack and Marysville districts, and it is safe to assert that more extensive means for working it will soon be supplied.

Messrs. Trask & Graves did some work on the well-known Dakota lode, though the ore is low grade. The same parties opened up a fine body of free-milling ore in the Wadams mine. No stoping has been done, but the ore can be readily taken out and milled when needed. With a larger mill than the present 5-stamp mill at Marysville the low-grade ore could be profitably handled.

On the Excelsior a rich vein of ore has been developed, averaging $65, and running as high as $200 per ton. A large amount of this grade is in sight.

On the Pioneer the main shaft has been dropped 65 feet and a cross-cut driven across the vein at the bottom 40 feet wide—all pay ore, free milling, and assaying $9 to $11 per ton. The ore developed is estimated by the thousands of tons.

The company organized for the purpose of opening a bed-rock flume on Grasshopper Creek below Bannack have done some of the preliminary work and claim that the ground to be opened by this means shows good pan prospects. During the coming season the work will be carried on unremittingly.

Rattlesnake Gulch has been worked to a considerable extent, and its placers, together with those of Fish Creek, Highland, Moose Creek, and the Rochester district have produced during the year not less than $50,000.

The *Birch Creek district* has developed much good ore, and its mines can be classed for the future as constant producers. The mines of the Railway Mining Company and the Birch Creek Prospecting Company have considerable high grade ore exposed, which assays well in both gold and silver. The latter company are the owners of a large magnetic iron mine, very valuable as fluxing in the reduction of refractory lead, silver, and copper ores, and for which there is a growing demand at the furnaces and smelters. These two companies have done much toward developing their properties during the past year, and to their energy is due most of the present activity of the district. The production during the year has been limited, and most of the operations performed with a view to the future.

The *Bluewing district* is near the Bannack. The most gratifying results have been produced here, and the district is conceded to be one of the best as well as the most extensive in Southern Montana. There can be little doubt that the application of modern machinery and the consequent development of the mines in this district will prove them to be of a permanent character, while the high grade of the ores guarantee their being remunerative. Much ore has been shipped and very large quantities are in sight and on the dump.

During the summer ore was sent from the New Departure mine to Dillon and thence to Salt Lake City by rail. This is the most thoroughly developed and worked mine in this district. It has 1,200 feet of tunnels, inclines, and shafts, opening up large bodies of ore, and it is estimated that there is $30,000 in sight. It produced $13,000 during the first four months of 1883. One lot of four car-loads of ore showed on assay a value of 275 ounces per ton in silver; one shipment of two car-loads of second-class ore left a net profit of $2,000, or $100 per ton. There is a quantity of both first and second class ore now on the dump.

Other mines less developed are capable or producing large amounts of paying ore. Noticeable among these is the Huron, which recently opened up some exceedingly rich gold and silver ore.

The lack of sufficient reduction works throughout this as in other districts is the one serious drawback to a large production.

Locations have been made and recorded in the county recorder's office for a new quartz district known as the *Horse Prairie district.* It is situated about 2 miles above the mouth and 1 mile from the creek of that name in the Bannack range of mountains. The lodes carry gold, silver, and copper bearing ore, and though little work has been done as yet, there is a fair prospect of their early and successful development.

The Chase Brothers are opening their copper mine a few miles from the line of the Utah and Northern Railway. A tunnel will be driven in, which will tap the lode at a depth of 30 to 40 feet from the surface; from the tunnel a shaft will be dropped on the vein to a depth of 100 feet. Assays of ore from this mine show copper in paying quantity.

The mines in the *Quartz Hill district* show considerable development and considerable ore on the dump. Prominent among them are the Lone Pine and Chipmunk, which send their ore to the arrastra near Divide, Silver Bow County. The Bonanza and Greely mines at Dewey's Flat have been sufficiently worked to supply the mill at that point with ore.

In the *Sheridan district* the Western Mining Company, Mr. F. J. Jones, superintendent, have erected a smelter. It was built by the Pacific Iron Works, of Chicago and San Francisco, and has a capacity of 30 tons. The engine is of the Corliss manufacture, and the boiler is sufficiently large to run 100 tons per day. With all the modern improvements the smelter has been so arranged that an additional stack of from 60 to 80 tons can be added to the plant if it should become desirable, and operated with the same power. This will have the effect of developing more thoroughly many of the neighboring mines. Average samples of ore from nearly all the districts in the county were taken during the latter part of the year and subjected to assay tests. The results were satisfactory to that degree that parties have decided to erect sampling works at Dillon, which is located on the Utah and Northern Railroad, and is easy of access from most of these districts. This prospect presents a new inducement for the extensive development of mines producing even second-class ores, inasmuch as even the individual miners may find a cash market for their product easily and at once, and net a fair profit on 40 and 50 ounce ores so plentiful in this county.

The Hecla Consolidated Mining Company, of Glendale, is one of the most prosperous companies in Montana, and it has been owing in a great measure to a management which has been characterized by ability, integrity, and economy that its mines have produced such satisfactory results. Supplied with modern improved machinery and appliances, the reduction of their ores has been economical and expeditious as well as thorough.

There are two water-jacket furnaces at Glendale, 9 miles distant, with a capacity of 100 tons per day. The concentrator was run continuously from January 1 to December 31, stopping only for the necessary repairs. It is a great success, and one of the best and most complete in the country; capacity, 200 tons daily.

The mines lie about in groups and include some twenty separate workings. Only a few of these have been continuously worked for the ore supplies, the balance having been opened up to a greater or less extent, with a view to having at all times a sufficient reserve in sight. Some of the workings in these mines have reached a depth of 1,500 feet, with a good grade of ore at the bottom.

The Hecla Consolidated Mining Company has a capital of $1,500,000, and on this amount $180,000 is paid in dividends annually, or 1 per cent. per month.

The following is a description of the most important operations, taken from the Butte Inter-Mountain:

"The mines on Lion Mountain, which have been and are at present producers, are in a band of dolomite, 1,100 feet in thickness, between bands of slate. Some of these mines have been worked to a great depth, deeper down than any other mines in Montana. The lowest workings have reached a depth of 1,500 feet.

"The highest mine on the mountain is the Cleopatra, which has been sunk to a depth of 750 feet. This mine has already produced over 30,000 tons of first-class ore and 10,000 tons of second-class ore. There is an equal amount of ore in sight in the mine, which is well ventilated and in shape for handling large quantities of ore.

"The Ariadne mine lies 60 feet lower down the mountain than the Cleopatra, and is a new mine. At 130 feet deep the incline is in a vein of high-grade ore, and the mine promises to be another Cleopatra. Forty feet farther down is the Marc Antony, which is only partially developed.

"The Silver Quartz has been worked to a depth of 750 feet. It has proven one of the best mines of the district. A reserve of first-class and large quantities of second-class ores are opened and ready for extraction. One pocket alone in this mine yielded 750,000 ounces of silver.

"The True Fissure has been the big mine of the company. It has yielded an immense amount of ore, and has been worked to an incline depth of 1,400 feet. Large bodies of second-class ore await extraction.

"The Mamie, a new prospect of the Fissure vein, is opening up finely.

"The Mountain Sheep has been sunk 1,500 feet, with large bodies of ore in the bottom. This, when worked, is a very productive property.

"The Atlantis Group consists of Atlantis Nos. 1, 2, and 3. Atlantis, No. 1 is down 1,400 feet. This mine is noted for its high-grade, self-fluxing ore. Atlantis No. 2 has been explored 1,000 feet deep and is the big mine of the group.

"The Alta and Oneida, on Lion Mountain proper, belong to the Hecla Company in full or part, and have been more or less developed, but are not ore-producers now.

"The Cleve mine, situated on North Mountain, is opened by a main incline shaft 750 feet deep, from which levels have been advanced 500 feet east and west, all in ore. The ore is a high-grade milling ore. This mine is rated as one of the best owned by the company.

"The Avon is a promising extension of the Cleve. Other mines of the company in what is called 'the basin' are looking well as far as prospected.

"The Lion Mountain tunnel, started at the base of the Big Mountain has been driven in for a distance of 1,500 feet. The tunnel has already passed through a 'blind vein' of excellent promise, and will in turn tap every vein in the mountain as it is pushed ahead.

"These are the mines that have for the past six or seven years produced the ore-supply which has kept the fires of the Hecla furnaces burning brightly at Glendale. The closing year of 1883 will show an output of over $1,000,000 worth of ore, with ore reserves sufficient to feed the furnaces for several years awaiting extraction from the mines."

The product of this company for 1883 was 12,466.365 tons of bullion, classified as follows:

| Description. | Pounds. | Ounces. |
|---|---|---|
| Lead | 5, 203, 919 | |
| Copper matte | 674, 695 | |
| Silver in lead | | 599, 472. 71 |
| Silver in copper matte | | 63, 363. 21 |
| Total ounces silver | | 662, 835. 92 |
| Gold in lead | | 402, 532. 00 |
| Copper | 308, 519 | |

A review of the mining districts of Beaverhead County presents a bright prospect for its future. Gold mining has decreased, it is true, but the increase in silver production has more than offset the loss. The ore yield has been more than fully sustained and the reserve ore and ore in sight fully justifies predictions of an increased production in the future.

I estimate the production of Beaverhead County in 1883 to have been, in gold, $75,000; in silver, $705,000; total, $780,000.

## DEER LODGE COUNTY.

During the past year some portions of this county have been decidedly active. The placers have turned out fairly and the silver product has been considerably increased over that of 1882. Some new locations have been made, but the important features of the quartz operations have been mostly confined to the old camps. These have added very materially to the annual output, and the gold product has been increased as well as the silver.

Pioneer continues to hold first place in the amount of gold extracted from placers, but it is still difficult to estimate accurately what the yield has been. A larger proportion of this product has been sent to the Helena assay office than during the previous year. Messrs Donnell, Clarke, and Larabie, of Deer Lodge, purchased 7,000 ounces, valued at $125,000.

Several companies and individuals have been operating to a considerable extent during the season, and although no figures could be obtained concerning the amounts taken out by them, the product of this region was fully equal to that of last year, when it was very carefully estimated and placed at $200,000. The entire placer yield is estimated as follows:

| | |
|---|---|
| Pioneer | $200, 000 |
| Bear and Elk Gluches and vicinity | 165, 000 |
| Other places | 110, 000 |
| Total | $475, 000 |

Cable Mountain.—The Cable mine has been steadily producing during the year. It is thoroughly developed, and at a depth of 140 feet shows a ledge of 80 feet wide, which has been uncovered to the 400-foot level. From this ledge pieces of quartz have been taken containing so large a percentage of free gold as to be practically nuggets. During the summer one piece of ore weighing 150 pounds contained $6,000, mostly in nugget form. In the early part of the year, dishonest miners succeeded in concealing and carrying away some $10,000 in nuggets, of which but $1,200 was recovered. The mine is provided with a 30-stamp mill and employs from 80 to 100 men. Owing to a scarcity of water only 15 stamps have been in operation during portions of the year, at which time the gold saved amounted to about $100 per stamp. The product of this company has not been less than $450,000.

The Pyrenees is also a gold property, near the Cable Mine, and is developed by four tunnels, which tap the ledge at a horizontal depth of 20, 50, 100, and 350 feet, and a drift, which has been driven on the ledge a distance of 800 feet east and west. The ore assays from $12 to $25, and the property includes a 5-stamp mill, which has been continuously operated during the year.

Near the Cable is also a group of mines known as the Southern Cross Group, which have been considerably developed and which will prove valuable producing mines in the early future. The operations performed on these lodes demonstrate the continuation of the Cable ledge throughout them, and the ore, which is abundant, assays as high is $25. The owners propose erecting a 20-stamp mill during the coming spring.

*Flint Creek mining district.*—Of the formation of the mines in this district the Inter-Mountain speaks as follows:

"The mines of the Flint Creek district lie in two separate and distinct formations, viz, lime and granite, and are notable as being of the true fissure class, with a uniform northeast and southwest strike, and generally dip to the horizon of 70°. The lime fractures at the point of contact enter immense beds or dikes of manganese, and, penetrating the granite, continue on without deviation from strike or dip. The gangue is a silicious quartzite, carrying native and ruby silver, the associated baser minerals being antimony, zinc, arsenic, and iron.

"In the enumeration of lode claims that, by reason of development and output may be considered of the representative class, the best exponent of the secondary formation is the Granite Mountain mine, which has three tunnels completed and the levels connected by winzes. The lower tunnel, at a depth of 700 feet, taps the ore, of which there is a large body, assaying 150 ounces or better.

Tunnel No. 4 is in about 400 feet, and the work is being prosecuted with the aid of a Burleigh drill. A portion of the ore is good milling ore and for a considerable quantity the treatment is reduction by crushing, chlorination, and the pan process. The company have been working their ores at the Algonquin mill, in the Phillipsburg district, but intend erecting a mill of their own at an early date.

The Helena Herald speaks of the Granite Mountain mine as follows:

The Granite Mountain mine is turning out to be a first-class silver property. The recent heavy shipments of bullion from the Granite Mountain mine, located at Phillipsburg, have attracted widespread attention to the old pioneer camp of Montana. Only a few years ago a well-known mining man of Helena was denounced as a fraud in Saint Louis, Mo., and his sale broken up because he offered a group of properties, including a portion of the Granite Mountain, on a capitalization basis of $100,000. To-day the fraction which he offered, with half a dozen other properties, for that price could not be purchased for five times the amount, and the Granite Mountain alone has shipped bullion valued at $200,000 during the past two months, the last shipment ten days ago amounting to $125,000. The principal work on the mine has been done during the past two years, and its development has proved a remarkable instance of the reward of success which often follows persistency in mining operations. The property is controlled by a company of Saint Louis capitalists."

The first annual report of this company states that the company owns eleven mining claims, aggregating 10,685 linear feet, in the Flint Creek mining district, 4 miles east of Phillipsburg. The development work, on the 21st of November last, consisted of 258 feet on tunnel No. 1, 998 feet on tunnel No. 2, 130 feet below No. 1, and 507 feet on No. 3, 140 feet vertically below No. 2. Nos. 1 and 2 are connected by a vertical shaft. The principal discovery of ore was in No. 2, 858 feet from the mouth, the rich chimney continuing 130 feet, varying in width from 2 to 7 feet and averaging 200 ounces. In June last contracts were entered into with the owners of the Algonquin mill, and a run of 505½ dry tons yielded \$85,900, and a second run of 929½ tons gave \$187,797.11, an average of \$190.86, all from No. 2 tunnel. The company has a No. 4 Burleigh compressor, three Burleigh drills, and a diamond drill used for prospecting.

The financial statement of the company for the period from September 3, 1881, to December 1, 1883, shows its receipts to have been \$273,897.81, the returns for 248,864 ounces of fine silver at New York. The company has expended \$64,216.34 for pay-rolls, supply bills, and freight; paid \$40,455.96 for milling; \$25,431.75 for real estate purchased; \$12,903.22 for supplies, machinery, and freight bills; \$3,402.14 for express charges, and \$3,726.36 for express on bullion. The works are in charge of a practical mill and mining man of large experience and acknowledged ability. The mine was discovered, located, and re-located years ago, but was not systematically worked until 1882.

The Butte Miner of November 21, 1883, says:

"The main tunnel, prosecuted at great expense for 1,000 feet, and striking the ledge at a depth of 250 feet, found at or near the point of intersection but the smallest streak of quartz, and, discouraged at the unfavorable outlook, the superintendent was about to give up the search and quit, when all at once the workmen broke in upon the displaced vein, which since has proved to be a veritable bonanza. Developments since have exposed an ore-body of the average width of 5 feet for a distance along the ledge of 730 feet, the quality of the ore being exceedingly rich. The Algonquin mill, under contract, is working continuously on the Granite Mountain output, handling 20 tons per day and turning out \$4,000 in refined bullion every twenty-four hours. Ruby ore abounds throughout the ledge, and the ore averages 200 ounces to the ton. The company early next year will erect a silver mill of 60 stamps, and work their property on an extensive scale."

The Speckled Trout mine is owned by the Northwestern Mining Company. It is developed as follows: Depth of main three-compartment shaft, 650 feet; extent of level development, 4,200 feet; winzes, 280 feet; cross cuts 170 feet; estimated tons of ore extracted, 7,000 tons; ore of all grades on the dump, 1,800 tons. The present grade of ore on the dump and in the stopes below the 259-foot station is 30 ounces. The width of the vein is 3 to 7 feet and is compactly filled. This mine produced largely from 1878 to 1880, high-grade ore coming from the stopes above the 259 foot level. The supply ceasing, deep sinking was resorted to, but the expense attendant was so heavy that the company had to suspend operation at great loss to themselves and employés.

The Algonquin mill has twenty stamps, and has been kept in operation almost constantly. One lot of 1,010 tons produced \$172,000. Careful estimates have placed the amount of good ore in sight at 200,000 tons. Considerable of a high grade has been shipped to Saint Louis for reduction. As nearly as can be estimated the yield from this mine will exceed \$350,000.

The Silver Lion is a recent prospect and bids fair to prove valuable. The ore taken out assays about 200 ounces. It is now under bond.

The Tidal Wave is one of the oldest discoveries in this district and is quite extensively developed. A large pocket was recently opened, in which the ore averages about 200 ounces.

The Algonquin and Trout are in about the same condition as at the last report. The ores taken out were of high grade and were worked at a profit. Both mines have still an abundance of ore, but of a grade which compels the suspension of operations at the present cost of working. The fine mill of the Algonquin is now operated by the company owning the granite mine and is supplied by their ore.

The Algonquin mine is owned by a Philadelphia stock company and is at present inactive. The depth of the main three-compartment shaft is 450 feet; extent of level development, about 2,500 feet; winzes and cross-cuts, 700 feet; tons of ore extracted and worked, 3,000. This mine has an immense amount of medium and low-grade ore in stopes and levels; the grade (at present cost of working), however, compelled the company to suspend operations until the price of labor and supplies would justify resumption of operations. Very complete hoisting works and a nearly new, superbly equipped, 20-stamp mill, supplied with a 60-inch Howell & White furnace, 10-foot calcining combination pans, and improved dry-crushing machinery form the remainder of the working plant of this company.

The Franklin, Salmon, and Bellflower are included in the properties of the Algonquin company, and are all good mines with proper development.

The Hope Company are the owners of the Hope, the Emma, and several other patented mines. The company is a well managed one and has paid in dividends to date $135,635. This year's dividend was $56,250.

The Hope mine has produced largely and is still worked at a profit. The company's 10-stamp mill has been continuously supplied with this ore and there is an abundant quantity in sight. Considerable work has been done in the way of development on both the Hope and Emma.

The superintendent of the Hope Mining Company reports as follows:

"During the year the company drove 280 feet of shafts, 461 feet of tunnels, 965 feet of levels, 55 feet of winzes, 157 feet of rises, 1,682 linear feet of stopes, at a cost of $45,147.50. The mill ran 188 days, crushing per stamp in twenty-four hours 2.45 tons of ore, or an aggregate of 4,529 tons, with an average assay of 26,895 ounces of silver. The average yield was 82.441 per cent.; 424 tons of tailings were also worked, carrying 21.554 ounces of silver per ton, yielding 65.986 per cent. The total cost of milling was $39,242.90, so that the cost per ton was $8.33. As in the case of many other Montana mines, the cost of salt was a very heaven burden, the present stock, the cheapest used, costing $55 per ton. The opening of railroads has, however, given relief, and salt can now be obtained from three competitive sources, delivered at Drummond station, on the Northern Pacific, 16 miles from the mines, at $25 per ton. The product during the ten months from January to October, inclusive, was $82,600."

The San Francisco is in the granite. It has a 3-foot vein assaying 90 ounces and better.

Last Chance has on its dump 200 tons of ore assaying from 80 to 600 ounces. Within this region there are numerous mines capable of producing a high grade of free-milling ore, and the activity of the district is giving impetus to their development.

The production of Deer Lodge County in 1883 I estimate to have been gold, $450,000; silver, $600,000; total, $1,050,000.

## GALLATIN COUNTY.

During 1883 the output of precious metals from the quartz mines of this county has not added materially to the total product, but the developments that have been made and are still in progress have proved beyond doubt that Gallatin County possesses an exceptionally rich mineral-producing region, which at an early day will acquire prominence in Montana mining.

The Clarke's Fork mines are comprised within a radius of about 6 miles, and number more than 200 locations. Many of these as far as explored are very rich, but the development in general has been retarded by the lack of sufficient mills and reduction works, the construction of which has been found a necessity, and, therefore, earnestly advocated. The character of the ores is varied, but consists mostly of gold-bearing quartz and galena which runs high in silver.

The Black Warrior, among the most prominent, has a depth of 90 feet in the shaft, and a number of tunnels; the vein is from 13 to 30 feet thick, solid galena, averaging high in silver and carrying in places thousands of ounces to the ton. Ore exceeding in value $60,000 is now on the dump; the ore also carries gold.

The Great Republic is perhaps the most extensively developed mine in this district. The vein is wide and regular and averages high in silver. At this mine is a 40-ton smelter, which will be in operation about January 1, with ore enough on the dump for its supply during the coming year.

Near these mines on Republic Mountain are a number of others which are more or less developed and whose ore is similar in character, being of high grade in lead and silver. Across the valley, on Miller Mountain, the character of the ore of the mines there located changes to a carbonate, which is found very desirable in facilitating the reduction of the more refractory Henderson and Republic Mountain ores. Copper and magnetic iron ores are also found here in abundance. At present two smelters are running, and three more are to be erected next spring. The product is a high grade of silver-lead bullion. The healthy activity pervading this camp bids fair for its growing prominence and prosperity.

In Crevice Gulch are a number of locations, mostly of rich gold-bearing quartz. One of these, at a depth in the shaft of 110 feet, shows a 10-foot ledge, all paying ore, from which 20 tons run through an arrastra yielded $1,300.

In Bear Gulch are a number of good pay placers in which preparations are now being made to work with hydraulics. In the mountains on either side there are numerous narrow but rich gold-bearing lodes, which are free milling and will be profitably worked when furnished with milling facilities. Emigrant Gulch has continued to be productive, and has probably yielded in excess of last year; preparations are under way to work during the coming season with hydraulics. One firm claimed to have taken out during the year over $20,000 by the ordinary process. Quartz mines are also coming into prominence here.

There are numerous other camps in this region, whose mines are developed to an extent that renders their future success a certainty. At present, however, the lack of capital compels their lying idle. As a whole considerable progress has been made in the county during the year in the increased facilities for the treatment of ores, and if with another season the amount of advancement which may be reasonably expected to be extended, the output of bullion from the already acknowledged resources must place Gallatin County among the most productive in Montana.

The product for 1883 I estimate to have been $35,000 in gold and $5,000 in silver; total, $40,000.

### LEWIS AND CLARKE COUNTY.

The yield of precious metals in this county has not increased perceptibly during 1883. Some of the mines have made no output at all, and some to a less extent than last year; but the deficiency can be accounted for in the fact that during the period in which they have not been operated, important and extensive improvements have been going forward which promise most favorable future results, and the decrease on the one hand has been counterbalanced by an increase from other mines.

From placers the product has varied but slightly. The bed-rock flume, 1¾ miles in length, in Last Chance has made it possible to work ground that has lain untouched since the early days that made this gulch so famous as one of the richest of placers, and during the coming season of 1884 there will probably be a considerable amount of dust extracted from ground lying within the city of Helena's limits. Many of the gulches tributary to Last Chance and those in the vicinity of Helena have been and are still producers.

| | |
|---|---|
| From Last Chance there was taken by— | |
| William A. Chessman | $10,000 00 |
| F. S. Getchell | 8,000 00 |
| Pierce & Co | 2,500 00 |
| Chinese and others | 5,000 00 |
| Total | 25,500 00 |

There are still nearly 200 acres of ground to wash. The water for this purpose is supplied from Ten Mile Creek and brought by ditches and flumes about 26 miles.

| | |
|---|---|
| The yield in Tucker and Dry Gulches was— | |
| R. S. Hale | $10,000 00 |
| Others | 2,000 00 |
| From Park City and vicinity | 20,000 00 |
| From Unionville, by— | |
| P. H. Constans | 1,000 00 |
| H. C. Carpenter | 1,600 00 |
| From Basin, by— | |
| Park and Halford | 2,500 00 |
| Others | 8,000 00 |
| From Ten Mile, Try Again, Monitor, and Lower Basin | 7,500 00 |
| From Silver Creek | 15,000 00 |
| From Green Horn and Saint Louis | 17,500 00 |
| From Virginia Creek; A. G. Clark | 3,000 00 |
| From Missouri River workings | 7,000 00 |

The amount of dust credited to Lewis and Clarke County deposited at the Helena assay office is about $120,000. The yield was in all probability somewhat in excess of this amount.

The lodes in the vicinity of Park City have only been worked to a slight extent, from which, as during last year, tributers have taken some $15,000 to $16,000.

The Lee Mountain Group in Ten Mile remains in about the same condition as at last report, little or nothing having been done toward further development since last season. There can be little doubt as to their value, or that the development of neighboring productive properties will cause at an early date renewed activity in this section. Owing to the limited means for the reduction of ores, many of the lodes that are known to have large quantities of paying ore in sight have been compelled to remain idle on account of the high cost of hauling over rough mountain roads and lack of means among the owners with which to build the necessary reduction works; some ore has been shipped, but only in limited quantities. The same condition is true of most of the mines in the vicinity, and the entire production has been trifling. During the coming year it is hoped that capitalists will take hold of this and the Red Mountain districts, which combined present prospects nowhere excelled in Montana.

The Frohner lode, on Red Mountain, is one of the few in which any progress has been made. This mine is down nearly 100 feet, cross-cuts and levels having been made showing an immense ore-body. There is scarcely any waste, and the vein is 15 feet wide. Something over 1,000 tons of high-grade ore have been taken out.

By far the most important features in the mining progress of this county during the year have occurred at the Drum Lummon mine at Marysville, and in the Bald Butte district. The following is a description from the Butte Inter-Mountain of the Drum Lummon improvements:

"The Drum Lummon.—During the past year this property has passed from the hands of Thomas Cruse, the discoverer, to the Montana Company (limited) of London, England. As nearly every one is familiar with the circumstances of the transfer of this mine, I shall not repeat what is already known, but proceed with a description of the mine, plant, and system of working such an immense fissure.

"Taking a new road that intersects the county road at the site of the much-advertised 5-stamp mill, where Mr. Cruse pounded out fame and fortune, and following said road around the hill on an easy grade several hundred feet, brings one to the structure known as the compressor building, size 60 by 100 feet. In this building stands the ponderous machinery that furnishes the motive power of the greater part of the system. The engine proper is 375 horse-power at present, but this power can be increased by the addition of more boilers. The following figures will give some idea of the size of the engine: Diameter of cylinder, 24 inches; stroke, 60 inches; fly-wheel, 24 feet in diameter, weighs 25 tons; shaft, with cranks, &c., attached, weighs 10 tons 470 pounds. The two tubular boilers, 54 inches in diameter and 16 feet long, furnish the steam at present. Six-inch pipes are carried up the mountain side through the Cruse tunnel into the load and operate two hoisting engines, one at each of the winzes which are being sunk to connect with the lower tunnel level. The compressed air escaping from these engines thoroughly ventilates the mine above the 150-foot level. From the Cruse tunnel a tramway, 600 feet in length, equipped with iron cars (holding 2 tons each), steel-wire rope, and Halladay's patent clip pulley, carries the ore down to a level with the Maskeleyne or lower tunnel and near the upper part of the 50-stamp mill.

"Connected with the huge building over the compressors is a first-class machine-shop, equipped in part with an 18-foot lathe, 30-inch swing; one drill-press, 40-inches in diameter; one screw planer, 40-inch stroke; No. 1½ bolt-cutter, from one-fourth to 1½ inches; also a 10 by 12 engine, which runs a swing-saw 4 feet 6 inches in diameter; one wedge-saw, 36 inches in diameter, &c. All timbers for this mine—and it will take forests—are sawed and prepared by machinery and skilled labor on the ground.

"The new mill.—The new 50-stamp mill will have no superior on the continent when finished. It will handle automatically 100 tons of ore per twenty-four hours. The plant in part consists of an engine capable of being worked as high as 500 horse-power. It will have iron combination pans and settlers, and in fact everything of the most improved pattern necessary for the treatment of gold and silver ores.

"The tunnel.—Directly on a level with the compressor machinery the Maskeleyne tunnel, 400 feet vertically below the outcrop of the lode, pierces the hill. This tunnel is a masterpiece of mining work, and has been driven nearly 900 feet by hand by picked miners. There remain about 150 feet yet before the ledge will be cut. It has been driven on an average of 120 feet per month since commencement. This tunnel is 7 feet high in the clear, $5\frac{1}{2}$ at the base, and $4\frac{1}{2}$ at the cap in the clear. At present it is ventilated by a water blast. The water drops 70 feet through boxes and strikes a step which gives a current of air to the face. The water flows out at the tunnel mouth. Four-inch iron pipes will convey the air from the compressors to the drills and other machinery to be operated through this tunnel. Sinking, stoping, and driving drills will be used, all operated with compressed air.

"The much-spoken of 5-stamp mill formerly run by Mr. Cruse would not now be recognized as the same. It has been thoroughly overhauled and now contains 10 stamps, two iron combination pans and one large settler. It is running regularly and saves on an average over 90 per cent. of the noble metals.

"The Drum Lummon mine is a full claim, 1,500 by 600 feet, secured by United States patent. Mr. Cruse, with his cross-cut tunnel nearly 400 feet in length, cut the vein 150 feet in depth and connected with the shaft sunk from the surface. From the Cruse tunnel level, drifts have been run both ways on the lode. Cross-cuts to both walls at intervals show the vein to be over 80 feet in width. The lode is opened up at this depth (150 feet) for a length of 700 feet. All rock taken out of these workings has gone through the mill. The vein dips southeasterly about 70° from the horizontal. The hanging wall is granite and the foot a porphyry formation locally called slate. The trend of the lode is northeasterly and southwesterly. The Cruse tunnel has been enlarged, straightened, splendidly timbered, and, like the Maskeleyne tunnel and tramway, is laid with a T-rail track.

"Under the present management two winzes have been sunk below this level 50 feet each, making a total vertical distance from the surface of 200 feet.

"Just to show the increase in value, I give the following figure obtained from reports sent to London, and not from any of the company's representatives here:

"Fifty tons unselected ore from the Cruse tunnel level yielded $74 per ton. One hundred and seventy tons unselected ore from the bottom of the winzes (200 feet from surface) yielded, silver, $51.85; gold, $38.50; total, $90.35 per ton."

The following figures have been furnished by Mr. George Attwood, general manager of the mine, as a result of experiments from 5 stamps:

Tons of ore crushed, $986\frac{1}{2}$; tons of bullion shipped, $2\frac{380}{2000}$; ounces in silver per ton, 28.50; average fineness of gold, $.023\frac{1}{2}$; percentage in lead, nil; value of whole, $64,310.46.

The Drum Lummon with its present development has sufficient ore in sight to supply the 80-stamp mill for a number of years, and if the new

1,000-foot shaft which it is proposed to sink should demonstrate the continued richness of the mine as a bullion producer, it will rank among the richest in the world.

The Belmont mill and mines have not been operated during 1883 but to a slight extent.

The Bluebird and Hickey mines have made a comfortable fortune for the owners, Messrs. Cotter, Hickey and Tierney. They have a 10-stamp mill which has been operated during the summer and fall on these ores, but attention has been principally directed toward opening up the Empire lode, which presents a prospect of rivaling in richness the most valuable of the neighboring mines. The product was about $10,000.

For the Albion and its associate mines a new 10-stamp mill has been built during the fall and new hoisting works added to one of the claims. The mines are about 1 mile from the Bluebird and Hickey, and have been worked but a portion of the year.

The Parker and Griff lodes have been well developed and have fulfilled the promise of their becoming valuable producers of gold. Each mine has 1,500 linear feet, and a large amount of free-milling gold ore is in sight, carrying not less than $30 per ton.

There are other lode properties in this vicinity that promise to become important on further development.

The Boston and Montana Company's Gloster mine operated its 80 stamps until August, crushing at the rate of 100 tons of ore per day. It was found about this time that a different method of treating the ore was necessary, owing to the increasing percentage of silver contained by the ore extracted from the lower workings of the mine. Twenty-four iron combination pans and twelve settlers were added to the 60-stamp mill which has recently resumed operations. During the time of undergoing improvements in the larger mill, the 20 stamps of the smaller mill were supplied by ore from the upper workings and the shaft was sunk to a depth of 400 feet from the surface; on the 300-foot level winzes were sunk to a depth of 60 feet and the vein found to be richer and wider than above.

The company have added to their improvements in the way of lighting apparatus 14 arc lights in the 60-stamp mill and 3 lights at the hoisting works. The power is supplied from the Corliss engine, which runs the stamps, to two Weston dynamos, which generate the electric current. The mine is to be lighted by the Maxim incandescent light, the dynamos for which are located at the hoisting works, and the power supplied by an independent engine, since it is necessary to keep the lights constantly burning. It is claimed these lights are economical and can be cheaply replaced, while the low tension of the current renders injury from contact impossible. Over the main shaft, which is 18½ by 7½ feet in the clear with two 5 by 6 cage compartments, are complete hoisting works, containing two large boilers and a 12 by 16 double-cylinder engine; a tramway connects with the 60-stamp mill and every appliance of modern mining machinery that can be available has made this plant one of the best equipped in Montana.

Since the introduction of the pans and settlers the additional process is as follows:

"From the battery the pulp is discharged through sluices into 48 settling tanks, each 4 by 3 feet by 3½ feet deep, and from these the sand is shoveled out and into 24 pans 5 feet in diameter, from which it goes into 13 settlers 8 feet diameter; water is thrown into the pans by means of centrifugal pumps, and the slums and extra water, by means of two large slum pumps, are carried to the top of the mill, and deposited into two large tanks, 12 by 20 feet dimensions. From these tanks the water goes to the batteries, and does not leave the mill until it finally goes through the amalgamating pans. The assay of the tailings indicates a saving of over 95 per cent. of the precious metals in the ore. It is claimed that the percentage named will be secured as an average of the current savings of the mill, and it is claimed that the stamps will each crush 4 tons of ore daily sufficiently fine for grinding in the pans. A 200-horse-power Corliss engine drives the stamps, and a 250-horse-power Union Iron Works engine runs the pans and settlers."

The product during 1883 is estimated to have been about $173,000.

There are a number of mines in this district, which have been under development and have added considerably in the aggregate to the total output.

I estimate the production of this county during 1883 to have been, in gold $250,000, in silver $50,000, making a total of $300,000.

## JEFFERSON COUNTY.

The Helena Mining and Reduction Company are now the owners of all the properties formerly belonging to the Alta Montana Company, and their works the most important in the county, being directly connected with a branch line of the Northern Pacific Railroad to Wickes. To the present time the Alta and Cornet have proven the best of the company's mines, but others will probably be shown to be quite as valuable when it becomes desirable to explore them. Since the change in the ownership and management of this property developments in the Alta and Cornet have been extensive, thorough, and satisfactory. The Alta is down 100 feet, and a strike was recently made on this lead which indicates a continuous body of ore to an unknown depth, and probably the same pay-chute as found above. The first-class ore runs about 100 ounces silver to the ton. It is estimated that above the 800-foot level there are fully 400,000 tons of ore in sight, which will average, without sorting, $20 in gold, 35 ounces in silver, and 19 per cent. lead, while the cost of mining will not exceed $2.50 per ton.

The Cornet has been developed by shafts and tunnels to a depth of 225 feet. In the recent working on this level, a body of galena was found assaying 70 per cent. lead and 65 ounces to 70 ounces silver. This body has already been exposed to a width of 5 feet, and may prove quite as valuable when entirely uncovered as the chute above, which in one place is 14 feet thick and solid galena. Exclusive of the rich ore in the lowest workings, the estimated quantity of ore now in sight is 2,500 tons, which will assay on an average 23 per cent. lead and 25 ounces silver. By sorting the ore the product can be easily raised to 100 ounces per ton. This ore, and the same is true of the Alta, carries some gold, and such is its character, that mixed with the harder and higher grade Alta ores, the smelting operations are rendered less difficult and the product is a high-grade bullion. The present capacity of the Cornet is about 50 tons.

Some distance below the old works are the new concentrators, with a capacity of 250 tons daily, and with the most approved modern improvements. As located, the cost of transportation of ore from the mine to the mill is reduced to a minimum. The smelter has a capacity of 35 tons, and will soon be started, but not to its full extent. The 15-stamp mill is crushing nearly 30 tons of ore every day, which is roasted and chloralized before amalgamation. The product in gold and silver has been about $300,000, and the operations have been conducted but a portion of the year.

The Gregory has been developed to a depth of 600 feet and 1,000 feet along the vein, which on the present lowest level is from 8 to 14 feet in width, of which 5 feet is galena. One hundred feet distant from the shaft a winze sunk between the fifth and sixth levels shows the vein to be from 8 to 12 feet wide, and to contain a large amount of high-grade ore. New hoisting works are to be erected and another level opened at 700 feet deep. A new concentrator, having two compartments, with a capacity of 75 tons each daily, and arranged to run independently of each other, has been built on the sight of the old one. It has two powerful crushers, four sets of 36-inch rolls, ten 3-compartment jigs, three large iron sizing-boxes, and three percussion, and will start at the beginning of the new year on an old waste dump carrying about $20 gold and silver, a large portion of which it is believed will be saved. The capacity of the smelter is 35 tons per day prepared ore and from 5 to 10 tons per day bullion. Most of the iron necessary for fluxing is found in the mine, and is thus furnished at small cost. The bullion produced during the year has assayed from $300 to $500, and the total output in gold, silver, and lead has been about $300,000.

On the Elkhorn Mining Company's claim a new hoist has been completed, and the development of the mine will be continued. The present depth is about 300 feet. The surface ore was free milling, but on attaining depth the ore became refractory for the process, and a new 10-stamp mill has been added to the plant, which has now every needed requisite to handle the ore economically and with the largest practicable percentage of saving. The hoist is now running, and preparations going forward to place the works in full operation by January 1, 1884. There has been no output during 1883. The ore averages about 50 ounces silver, and as there is a large quantity in sight, the showing for 1884 will be a fair one. In this district are a number of mines that have been under development during the year, from some of which ore of a high grade has been taken out and shipped. Some of these will doubtless acquire prominence as developments and improvements progress upon them.

The Little Giant mine produced between $16,000 and $17,000 during the year. The yield from other mines in the vicinity was from $3,000 to $4,000.

The placers put out an amount in the aggregate varying but little with the yield of last year and probably not less than $55,000. I estimate the production of the precious metals in this county in 1883 to have been in gold $350,000 and silver $100,000; total, $450,000.

## MADISON COUNTY.

The gold yield from this county was about the same as last year, Alder Gulch and its tributaries having produced about 80 per cent. of the total product. Henry Elling, at Virginia City, bought 7,760 ounces, valued at $122,025. Most of this amount was from placers. Messrs. Raymond, Harrington & Co., also of Virginia City, bought about $100,000, of which 80 per cent. was from Alder Gulch and its tributaries, 10 per cent. Harris, Bivens, California, and Wisconsin Gulches, and the balance from quartz mines principally in Red Bluff district. The reduction works at Pony, as projected by Henry Elling, of Virginia City, will soon be in operation. Mr. Elling is the owner of large interests in this district, and is doing much toward its development. The plant includes a 20-stamp mill, four Frue vanning machines, Blake crushers, &c. The power is furnished by a Leffel turbine wheel, and when entirely finished and in operation will be the most complete works in Madison County.

The Elephant lode, owned by the same party, shows considerable development. The vein in places is fully 50 feet wide, and assays from $5 to $50 per ton. The surface ore is free milling.

At Red Bluff a body of good ore, 12 feet in width, has been struck in the Golconda mine, which will no doubt necessitate the enlargement of the mill and concentrator.

The Mohegan is a wide, rich, gold-bearing vein that is developed by a shaft to a depth of 110 feet, water-level.

The Red Bluff lode is developed by a tunnel to a depth of 115 feet, where the crevice is 6 feet in width, with quartz averaging $20 in gold and $20 in silver per ton.

The Greenback is a vein of gold quartz, averaging $65 per ton, and is developed to a depth of 300 feet. Numerous other promising mines are in the course of development in the camp, and a 10-stamp mill for the Superior lode, in the same district, is being erected.

*Tidal Wave district.*—Of this district the Engineering and Mining Journal of September 22, 1883, speaks as follows:

"In 1864 considerable work was done by prospectors who were looking for gold. As the cost of transportation was too heavy in those days, and anything but gold was valueless to them, the consequence was that silver, lead, copper, and other minerals were abandoned. In 1881, working facilities being better, the camp was again prospected for silver, and with good success. At the present time there are at least a hundred good paying prospects, and new leads are struck every day. The veins are all well defined. This summer a 20-ton water-jacket smelter was put up, and is running in full blast on galena and other smelting ores with which this camp abounds. There were also erected oscillating-works to treat the gold quartz of the numerous gold leads. A 10-stamp gold mill and two arrastras are working in Wisconsin Gulch, and they have plenty of good quartz to keep them running for a number of years to come. The mines are all easy of access, and so far there has been no trouble with water. The formation is principally granite and slate, and higher up the mountain the formation is all lime and quartzite.

"A correspondent of the Butte Miner writes from Pony that several mines are worked with satisfactory results. The dump-piles are increasing in size, and the Getchell 10-stamp mill will shortly have to be started up to accommodate the wants of the camp.

In the immediate vicinity of Virginia City, the Bell, Way Up, U. S. Grant, Prospect, Nantucket, and Almeda lodes have been worked, and an impetus given to development in this section by the proposed addition of 10 or 15 stamps to those of the Virginia City Reduction Works which have been in operation.

The Bell has two tunnels, of which one is 400 feet; the average width of the vein is 15 feet, and assays from 35 to 45 ounces silver and carries considerable gold.

The prospect is 35 feet deep in the shaft, at the bottom of which a level has been driven 220 feet. The ore assays about 50 ounces silver. Below are two tunnels in 200 and 400 feet, respectively, showing the vein to be from 10 to 12 feet and assaying from 40 to 50 ounces silver. A concentrator of 130 tons capacity is in process of construction, and will be enlarged if found successful.

Near Sheridan, about 20 miles from Virginia City, on Wisconsin

Creek, smelting works now about completed will be put into operation early during the coming season.

In the Tidal Wave district is a 20-ton smelter nearly completed, and work in consequence is being rapidly pushed.

The Magnolia is one of the best prospects in the district, and assays made gave 60 ounces silver, $17 in gold, and 68 per cent. lead.

The Broadway mine and mill is soon to be started again.

The improvements which have been completed and those now in progress cannot but give an impetus to the mining operations of this county, and the result will be felt in the largely increased output which the extended facilities of treating the ores will make possible during the coming year.

I estimate the production in Madison County in 1883 to have been, gold, $240,000; silver, $20,000; total, $260,000.

## MEAGHER COUNTY.

Meagher County has yielded in precious metals somewhat in excess of 1882, owing to the increasing development and improvement on lode claims. The placer yield has fallen off slightly, but the output from the mills and smelters has been sufficient to more than counterbalance it. The output in gold bullion from the various mills has been fully $35,000, against $3,000 during 1882.

The activity has been quite as great in the *Montana district* as in any other, and though none of the mines have reached an unusual depth the assays indicate an average of high grade; many of the veins are narrow, but very rich, and ores have been shipped even in small quantities at a profit.

The Massachusetts has reached a depth of 70 feet. The lead is 4 feet from wall to wall, and the rich streak, which varies in width from 8 inches to 1 foot, has continued all the way down.

The Montana Belle is down 30 feet, where the vein shows a width of 5 feet. The best of the pay ore is about 2 feet wide, and assays average 600 ounces per ton. Considerable ore has been sorted, sacked, and hauled over the mountain, to be shipped by rail early in the spring.

The St. Julian is sinking a shaft 125 feet; at 50 feet the character of the ore is the same as in the Montana Belle and very rich. In the Deadwood lode the vein is 15 feet wide.

The South Carolina No. 2 is near the Massachusetts, and the ore is similar. Development is progressing favorably.

The vein in the Huxley at 35 feet is 6 to 7 feet wide. The pay ore is nearly a foot wide and averages 300 ounces silver.

The I X L has a 5-foot vein carrying both gold and silver.

The tunnel of the Queen of the Hills and Homestake lodes early in the season was run in on the vein 180 feet, and at a point 90 feet below the surface the ore body was 5 feet thick. The ore is rich in wire, brittle, and sulphide of silver, and shows also some ruby silver. These leads are now under bond for $90,000.

The *Maiden district* is situated in the Judith Mountains, near Fort Maginnis, and the work of the year has only tended to increase the belief in the value and permanency of the mines.

The Collar mine is one of the most thoroughly developed. At a depth of 100 feet in the shaft the vein is 17 feet wide, and contains a good average grade of free-milling ore. At 230 feet a tunnel taps the vein, which is 20 feet wide and runs high in gold. During the season nearly $150,000 has been expended in erecting a new mill, which has all the latest appliances for the treatment of the ore, and the output will add largely to the county product during 1884.

The Montana and Oro Cache mines, belonging to Messrs. Hauser & Holter, of Helena, have been in operation most of the season. The ore is nearly all paying and is said to average $50 per ton, mostly gold. At a depth of 50 feet the mine has a width of 24 feet, of which 17 feet is pay ore. A number of improvements have been made in the mill which have very materially increased the savings of gold. The capacity is from 15 to 24 tons each twenty-four hours. The output has been $20,800.

The Spotted Horse has an 8-foot vein at 60 feet, and only one wall in sight.

The Alice in the same vicinity is a promising lode.

In the War Eagle, at a depth in the shaft of 50 feet, a cross-cut opens up a 20-foot vein, which assays 60 to 70 ounces silver and some gold.

The North Pacific and Silver Star lodes are both rich; both have taken out ore of high grade for shipment.

*The Barker district.*—Deposits of galena copper were first discovered in this district in 1879, and although the existence of gold and silver was suspected, it was only the large copper and galena deposits that were actually discovered. Many of the mines in this district are patented, but owing to the lack of facilities for shipping the ore has not been developed to any great extent, but the near approach of the railroad will hasten the development of the mines in this and the adjacent districts.

The Clendenin Mining and Smelting Company, at Gold Run, is now in successful operation, and they have recently made a shipment of four car-loads of silver bullion, in bars of 97 pounds each, to Chicago. This bullion was hauled by a wagon train 123 miles, to Muir City, where it was placed on cars.

Among the promising mines of this district are the Wright and Edwards, Barker, May and Edna, Brothers, Vanderbilt, Meek, Silver Belle, and Pittsburg.

In *Dry Fork district*, about 4 miles distant, are a number of mines being developed, and southward and a little west, across the range, is the *Belt Park district*, containing a number of mines. Among the more promising may be mentioned the Whippoorwill, Uncle George, Hughes, and De Lorrier lodes, all located upon the same vein, and showing large bodies of ore, the vein being rich in copper, gold, and silver, besides large quantities of galena.

Four miles further south is the *Montana district*, in which the more promising mines are the Sampson, Queen of the Hills, and Fitzpatrick.

About 10 miles northeast, on the Judith Slope, is the *Running Wolf district*, with rich dolomitic veins, the most prominent of which are the Sir Walter Scott, Mystery, and Running Wolf; and on Sage Creek there are a number of locations, while in Yogo a large number of lodes are now being developed.

*Maiden Gulch.*—There are a number of mines located here. The Montana Mining Company was the first to erect machinery. They have in operation a Huntington oscillating stamp mill, which is reported to be doing good work and making satisfactory returns to the owners.

*Niehart district.*—This is a new district. It is located in the heart of the Little Belt Mountains, on Belt Creek. The rocks of which the district is mainly made up are of a porphyritic character, with some slate and syenitic granite porphyry. The ores of this district are both milling and smelting, the latter lead ore; a small percentage of carbonate and sulphate of lead is found near the surface in places, but galena largely predominates. The ores are free milling, and so far as ascertained are of all grades, from a few ounces in silver to several hundred dollars per ton. The developments are too limited as yet to admit of our opinion as to permanency, but the indications are favorable. The district is well supplied with wood and water.

From Diamond Flume and Hydraulic Company's placers in Confederate Gulch, which has produced nearly one-third of the placer yield, the product has somewhat decreased, but is known to be fully $15,000.

| | |
|---|---|
| Diamond Flume and Hydraulic Mining Company | $15,000 |
| Other placers in Confederate and tributary gulches | 8,000 |
| From Cave Gulch | 8,000 |
| From Avalanche | 9,000 |
| From other placers | 15,000 |
| Total | 55,000 |

I estimate the production of Meagher County in 1883 to have been: Gold, $60,000; silver, $20,000; total, $80,000.

## MISSOULA COUNTY.

In the *Sweathouse district* are a number of new locations, and the mines have proved richer than at first supposed. Although the district is further advanced in its development than any other, but little progress has been made in the facilities for treatment of ores, notwithstanding their high grade.

The Pleasant View, owned and operated by Hon. H. E. Bass, has a shaft 125 feet in depth. On the vein levels were run at 50 and 100 feet, for the purpose of exploring the vein. Considerable ore from the shaft and levels is on the dump, and the ledge has a uniform width of 4 to 5 feet. The expenditures in development have exceeded $8,000, but to the present time there has been no bullion production.

The Bitter Root smelter has produced its first bullion. The smelter, which was erected on trial, has been found to work satisfactorily, and will have a tendency to increase the ore and bullion output in the future.

The placers worked have not yielded quite as largely as last year. The Missoula National Bank, at Missoula, purchased gold dust to an amount slightly exceeding $44,000, most of which found a market outside the Territory. The placers worked, were in Three Mile, Nine Mile, Cedar Creek, Quartz Creek, and Trout Creek, and their yield has comprised the product of the county.

The production of this county in 1882 I estimate to have been $40,000 in gold.

## SILVER BOW COUNTY.

Although Silver Bow is Montana's smallest county, with the exception of Leadville, Colo., it contains probably the most productive mining district in the United States.

Of the *Summit Valley mining district* Butte is the center; its mines, mills, and reduction works have achieved a wide reputation, and the product for 1883 will have a strong tendency to make this camp, if possible, even more famous.

The Alice has made a fine showing for the year. Although no important changes are to be noted in the upper levels, good progress has been made in the development of all the workings. In the 800-foot level the main ore-body was tapped at a distance of 105 feet west of the shaft. This chute has run the entire length of the Alice property, and has carried good paying ore throughout. Work has been diligently prosecuted throughout the mine, and the company's 80 stamps have been supplied in part by this ore. Some stoping has been done in the upper levels.

The Magna Charta, also the property of the Alice Company, has furnished the mills with the greater portion of their supply, the ore milling from 30 to 40 ounces. The mine is down 600 feet, and the ore is of a good grade. Development is constantly going forward. The output of the Alice Company has been over $100,000 gross per month. The product in gold and silver for the year was $1,126,300.

Clark's Fraction is near the Alice and has been under development from the Alice workings. Considerable ore has been uncovered, assaying $40 and better, which has been treated in the Moulton mills; some samples assay as high as 500 ounces per ton.

The Lexington has done but little in lowest workings, but that has proved sufficient for preparations to resume the sinking of the shaft. On and above the 400-foot level the mine has been thoroughly and systematically developed, and the ore now in sight will supply the mills for a long period ahead. The character of the ore requires chlorination before milling. About 60 tons per day have been mined, which has been increased by ore from the Allie Brown. The company has 60 stamps, of which 50 are running on ore and 10 on salt, all of which is dry crushed. The ore is calcined in two Stetefeldt furnaces. The 10-stamp mill has been run a portion of the year on tailings, with which a certain quantity of ore has been mixed. Battery samples have assayed $55, of which 5 per cent. is gold. The 50-stamp mill is one of the finest on the Pacific slope and has been running almost continuously since it was started in November, 1882, during which time it is claimed that its product has in no instance been less than $95,000 per month. The gross output of this company has been about $1,400,000, of which from the annual report of the company there was: Gold, $162,600; silver, $1,125,700; total, $1,288,300. The bullion produced during the first six months realized $638,458. The first dividend was paid in July, and amounted to 1,000,000 francs.

The three-compartment shaft of the Moulton mine has attained a depth of 500 feet. In the workings above the 400-foot level the mine is looking about as usual, and has been producing during the latter portion of the year about 20 tons of ore daily. On the 400-foot level a cross-cut has been driven in the west drift about 700 feet, and is now in good ore. The usual output of 40 tons will soon be resumed. The 40-stamp mill of this company is a fine structure and is in excellent condition. It has two 40-inch Howell roasters, which chloridize the ore to a high percentage, and which have been partially supplied with custom ore. The Moulton ore carries from 30 to 40 ounces silver and some gold. The total gross product was $376,700.

The Silver Bow Company have a 30-stamp mill, and have lately been operating on ore from the Josephine, because of its high grade. The Grey Rock, also one of their mines, has been supplying a portion of the ore, and this has sampled about $42. Their principal mines, the La Plata, 400-foot shaft; Belle of Butte, 36-foot shaft; Grey Rock, 300-foot; and Mount Moriah, 200-foot shaft, have been restricted in their output, owing to the limited capacity of the mill. The mill has a Howell and White cylinder roaster, which has given satisfaction in chloridizing their ore, the average assay of which has shown $35 per ton saved. Their net product has been $365,000 in gold and silver.

The Dexter mill has 15 stamps and is wet crushing. It has been running low-grade custom ore, and has put out 195,000 ounces silver, worth $1 per ounce, or $195,000 in silver. A portion of the year it has been operated on Anaconda free-milling ore.

The Anaconda has proved to be one of the most extensive copper-silver mines in the country. It is owned by the Anaconda Mining Company, who have outlaid an enormous amount of money in its development and the construction of suitable works for the treatment of its ores. The mine has over 5,000 feet of levels, although no stoping has been done, and can easily furnish 500 tons of ore per day. That in the upper levels is free milling, while below the 200-foot level the ore carries an increasing percentage of copper, until on the fourth, fifth, and sixth levels the ore is almost exclusively copper-bearing for the entire width of the ledge. The free-milling ore assays about $30; but there are large bodies of ore of a high grade, rich enough to ship, not free milling, above the copper levels. A large force of men have been employed in the construction of the smelter, now nearly completed. These works are located on the north side of Warm Springs Creek and have a capacity of 500 tons. The second-grade ores of the Anaconda and Saint Lawrence are made into matte, carrying about 65 per cent. copper. The hoisting works at the mines have a capacity of 750 tons. It is claimed that nearly $1,000,000 have been expended in buildings, machinery, and development.

The Saint Lawrence is an extension of the Anaconda and is owned and operated by the same company. Its development has been systematic and thorough; it has a depth of 500 feet, and produced a large amount of ore similar in character to that of the Anaconda, and of which its works are duplicates. The total product of the company is estimated to have been from $1,400,000 to $1,700,000, of which at least $600,000 was silver.

The Montana Copper Company has been treating 100 tons of ore daily, from which the product has been from 25 to 30 tons of matte, assaying from 60 to 65 per cent. copper and from 75 to 200 ounces of silver. The ore has been mostly taken from the Colusa mine, which has a 3-compartment shaft 420 feet deep and several thousand feet of levels. Its daily output is about 100 tons, but its capacity is fully double that amount. Its ores run from $18 to $40 in silver and 25 per cent. copper. Some high-grade silver ore has been taken from the 400-foot level and shipped to Swansea. The company has kept their one blast furnace and five matting furnaces operating continuously, and have shipped on an average 25 tons of matte daily. It has other productive mines, but with the exception of the Liquidator, which has furnished some quantity of ore, the Colusa has kept the plant fully supplied. During twelve months ended September 1, 1883, the product shipped was 8,100 tons, carrying 65 per cent. copper and 53 ounces silver. The company's gross product was $2,103,420, of which $318,700 was silver.

The Liquidator is a productive mine, but has not been worked to its full extent during the year; a portion of the time it has produced 100 tons daily, carrying from 18 to 35 per cent. copper, and has had large amounts of ore on its dumps. From sales of ore about $40,000 has been realized, and the product of ore treated at the Montana smelter, included in the estimate of that company, nearly $142,000. The depth of the shaft is 200 feet.

The Poser has attained a depth of 200 feet. The vein is 18 feet wide in the upper level and assays on an average $35. Running longitudinally through this ore-body is a streak 4 feet thick that pulps 100 ounces in the mill. In six months 3,000 tons of ore from this level were sent to the Silver Bow Company's mill and worked at a profit.

The Bell.—The smelter has been operated a portion of the year and produced good results, treating about 40 tons of ore daily. The development of the mine has been principally confined to the 400-foot cross-cut that is to connect the old and new workings. Considerable ore, however, was taken out, and some uncovered that carried 50 per cent. copper and $65 silver. A small quantity of ore was shipped to Swansea and the balance treated at the smelter. The silver contained in the matte amounted to about 144,000 ounces.

The Gagnon has a three-compartment shaft 500 feet in depth and five levels. The pay streak is found on the foot wall and is from 5 feet to 9 feet wide, and assays about $60 in silver and carries 12 per cent. copper. The upper levels yield mostly a lower-grade ore of about 30 ounces, and of which there are thousands of tons in sight, though not available at present as pay ore owing to the cost of reduction. An immense ore body in the lower levels has been uncovered and partially extracted which is of a high grade, and is likely to prove the Gagnon one of the best mines of the district. Of the ore part was shipped and part treated at the Boston and Montana smelter.

The Original, east of the Gagnon location, has a pay streak from 3 to 8 feet wide, similar in grade to that of the Gagnon. It has paid dividends of $3,000 monthly for a period exceeding two years. The ore was partly shipped and partly sent to the Boston and Montana smelter.

The Clear Grit is increasing its percentage of copper as depth is attained. The ore in the upper levels is a sulphide of silver with quartz, and assays from $100 to $400. The shaft has reached a depth of 217 feet, where there is a 30-foot vein of copper ore and a large body of copper pyrites. It is owned by the Clear Grit Mining Company, of Philadelphia. Its ore is mostly treated at the Colorado and Montana smelter.

The Shonbar is one of the important mines of the camp. Its shaft is down about 325 feet, and its development is systematic. During the year a large quantity of ore of good grade has been taken out, of which part was shipped and part was treated at the Silver Bow mill.

The Original Butte and Vulcan properties are acknowledged to be valuable, but have not been worked, being still in litigation. The Original Butte is on the west of the Gagnon, and the Vulcan adjoins the Shonbar.

The Colorado and Montana Smelting Company have purchased a number of good properties in this district, but have been operating mostly on custom ores. Their smelter has been running continuously during the year on custom ores from the Gagnon, Clear Grit, Original, and other mines. The product also includes the output of the Star West, Mountain Boy, and other mines which the company own. The fluxing ores, containing silver, are also from the company's mines. The smelter has a capacity of 50 tons daily, and is to be increased during 1884. The product has assayed on the average 50 per cent. copper, and has varied from $600 to $1,500 per ton. There have been at least 5,000 tons of crude ore shipped to the Argo works, in Colorado, of which this company is a branch, and at the close of the year from 7,000 to 9,000 tons of crushed ore await treatment at the smelter. The 50-ton concentrator has been steadily in operation. Its product was $740,000 silver.

The Parrott Company have a well-developed mine, with a present depth in the shaft of 300 feet, and from 8 feet to 12 feet of ore, carrying from 20 per cent. to 70 per cent copper and large quantities of concentrating ore. The smelter has been run at its full capacity, producing from 10 to 15 tons of matte per day, and the capacity of the concentrator is being increased. The company are large copper manufacturers in Connecticut, and have use for their own product. The output for the year is 5,250 tons copper matte, which possessed a gross value of about $1,000,000. It contained 6,700,000 pounds of copper, worth $938,000, and $60,000 in silver.

There are very many mines in this district which have been producing ore constantly, of which no accurate estimate can be made, but amounting to not less in the aggregate than nearly half a million dollars. Crude ores shipped from the Sagmon, Original, Shonbar, Lexington, and other mines not heretofore included exceed 7,000 tons, and have carried not less than $70 in silver per ton, the lowest amount which will pay to ship, or $490,000. The placers in the county have yielded about $25,000.

The production of gold and silver in this county during the year 1883 I estimate to have been in gold $300,000 and in silver $4,500,000, making a total of $4,800,000, being an increase over that of 1882 of $1,060,000.

# CHAPTER VIII.

## NEVADA.

Considerable material for the review of the mines of Nevada was collected by Mr. Crawford, the superintendent of the Carson mint, and partially compiled. I have added such additional information as was attainable, and made the estimates of the yield of the several counties and total product of State upon comparison of these data with the shipments from the State by express and railroad and the returns made to the county assessors of the quantity and value of the ore extracted from the different mines. There was considerable increase in the yield of gold and corresponding decline in the amount of silver, the total value continuing to decline as in previous years. I have estimated the yield by counties as follows:

| Counties. | Gold. | Silver. | Total. |
|---|---|---|---|
| Churchill | $5, 000 | $20, 000 | $25, 000 |
| Elko | 30, 000 | 550, 000 | 580, 000 |
| Esmeralda | 60, 000 | 890, 000 | 950, 000 |
| Eureka | 600, 000 | 850, 000 | 1, 450, 000 |
| Humboldt | 30, 000 | 80, 000 | 110, 000 |
| Lander | 30, 000 | 1, 300, 000 | 1, 330, 000 |
| Lincoln | 30, 000 | 225, 000 | 255, 000 |
| Lyon | 45, 000 | 70, 000 | 115, 000 |
| Nye | 20, 000 | 180, 000 | 200, 000 |
| Ormsby | 5, 000 | 5, 000 | 10, 000 |
| Storey | 1, 600, 000 | 900, 000 | 2, 500, 000 |
| Washoe | 15, 000 | 10, 000 | 25, 000 |
| White Pine | 50, 000 | 350, 000 | 400, 000 |
| Total | 2, 520, 000 | 5, 430, 000 | 7, 950, 000 |

Messrs. Wells, Fargo & Co.'s statement shows that there were carried from the State $1,097,595 gold, $5,924,253 silver, the latter at its coining rate equal to $6,963,307, a total of $7,060,902, probably not including the value of base metals. The silver, however, contains considerable gold.

The aggregate quarterly returns to the county assessors state that the quantities and values of the ores extracted by the several counties in the last and previous year compare as follows:

*Returns made by the mines to the county assessors for the years* 1882 *and* 1883.

| Counties. | 1882. | | 1883. | |
|---|---|---|---|---|
| | Quantity worked. | Value. | Quantity worked. | Value. |
| | *Tons.* | | *Tons.* | |
| Churchill | | | 289 | $1, 451 99 |
| Elko | 4, 199 | $333, 784 46 | 4, 224 | 526, 496 15 |
| Esmeralda | 25, 941 | 1, 011, 121 62 | 20, 121 | 898, 158 93 |
| Eureka | 71, 840 | 2, 453, 306 38 | 69, 975 | 1, 615, 294 39 |

*Returns made by the mines to the county assessors for the years* 1882 *and* 1883—Continued.

| Counties. | 1882. | | 1883. | |
|---|---|---|---|---|
| | Quantity worked. | Value. | Quantity worked. | Value. |
| | *Tons.* | | *Tons.* | |
| Humboldt | 3, 942 | $42, 597 14 | 7, 566 | $101, 487 97 |
| Lander | 4, 156 | 575, 964 48 | 4, 121 | 865, 682 85 |
| Lincoln | 38, 387 | 457, 806 56 | 37, 040 | 254, 401 12 |
| Lyon | 50, 773 | 182, 210 60 | 58, 466 | 165, 091 33 |
| Nye | 8, 742 | 216, 216 62 | 7, 280 | 201, 222 63 |
| Ormsby | 1, 506 | 6, 975 13 | ......... | ............ |
| Storey | 114, 611 | 1, 575, 096 97 | 128, 802 | 1, 829, 194 82 |
| White Pine | 6, 602 | 265, 687 29 | 15, 361 | 321, 323 34 |
| Total | 330, 699 | 7, 120, 767 25 | 353, 245 | 6, 779, 805 52 |

As usual, the mines of Nevada, and especially those of Storey County, have called upon their stockholders for further advances to prosecute explorations in the search for new or richer ore bodies. A few, six in all, have been able to pay dividends and have disbursed in twenty-five dividends a total of $644,000 to their fortunate stockholders, while 51 mines have called by assessments for $4,269,940.

The following is a list of assessments levied and dividends paid by Nevada mines during the calendar year ended December 31, 1883:

| Names of mines. | Assessments. | | Dividends. | |
|---|---|---|---|---|
| | Number. | Amount. | Number. | Amount. |
| Alpha Consolidated | ...... | ......... | ...... | ......... |
| Alta | 3 | $81, 000 | ...... | ......... |
| Andes | 3 | 75, 000 | ...... | ......... |
| Albion Consolidated | 3 | 169, 000 | ...... | ......... |
| Argenta | 3 | 80, 000 | ...... | ......... |
| Atlantic Consolidated | 1 | 5, 000 | ...... | ......... |
| Best and Belcher | 2 | 100, 800 | ...... | ......... |
| Belcher | 1 | 26, 000 | ...... | ......... |
| Bullion | 2 | 40, 000 | ...... | ......... |
| Benton Consolidated | 3 | 32, 400 | ...... | ......... |
| Belmont | 1 | 7, 500 | ...... | ......... |
| Belle Isle | 1 | 25, 000 | ...... | ......... |
| Caledonia | 1 | 10, 000 | ...... | ......... |
| Consolidated Virginia | 1 | 208, 000 | ...... | ......... |
| Challenge Consolidated | 1 | 50, 000 | ...... | ......... |
| Chollar | 2 | 168, 000 | ...... | ......... |
| Concordia | ...... | ......... | ...... | ......... |
| Confidence | 1 | 6, 240 | ...... | ......... |
| Consolidated Imperial | 2 | 50, 000 | ...... | ......... |
| California | 3 | 324, 000 | ...... | ......... |
| Crown Point | ...... | ......... | ...... | ......... |
| Daney | ...... | ......... | ...... | ......... |
| Dayton | ...... | ......... | ...... | ......... |
| Day | 2 | 60, 000 | ...... | ......... |
| De Frees | ...... | ......... | ...... | ......... |
| Exchequer | 1 | 20, 000 | ...... | ......... |
| Eureka Consolidated | 4 | 200, 000 | ...... | ......... |
| East Mount Diablo | 1 | 5, 000 | ...... | ......... |
| Elko Consolidated | 2 | 30, 000 | ...... | ......... |
| Endowment | ...... | ......... | ...... | ......... |
| Eureka Tunnel | 1 | 50, 000 | ...... | ......... |
| El Dorado South Consolidated | ...... | ......... | ...... | ......... |
| Golden Gate | ...... | ......... | ...... | ......... |
| Gould and Curry | 3 | 162, 000 | ...... | ......... |
| Grand Prize | 3 | 75, 000 | ...... | ......... |
| Gilo | ...... | ......... | ...... | ......... |
| Hale and Norcross | 4 | 224, 000 | ...... | ......... |
| Highbridge | ...... | ......... | ...... | ......... |
| Holmes | 2 | 60, 000 | ...... | ......... |
| Hussey | ...... | ......... | ...... | ......... |
| Hamburg | 1 | 25, 000 | ...... | ......... |
| Independence | 2 | 60, 000 | ...... | ......... |

| Names of mines. | Assessments. | | Dividends. | |
|---|---|---|---|---|
| | Number. | Amount. | Number. | Amount. |
| Indian Queen | | | 1 | $15,000 |
| Ivanpah | | | | |
| Julia Consolidated | 1 | $11,000 | | |
| Justice | 2 | 21,000 | | |
| Jo Skates | | | | |
| Jackson | | | | |
| Kentuck | | | 8 | 24,000 |
| Knickerbocker | | | | |
| Kossuth | | | | |
| Lady Washington Consolidated | 1 | 5,400 | | |
| Leviathan | | | | |
| Lady Bryan | | | | |
| Leopard | | | | |
| Mexican | 3 | 252,000 | | |
| Mackey | | | | |
| Mint | | | | |
| Manhattan | | | | |
| Mount Diablo | | | 4 | 50,000 |
| Mount Potosi | 2 | 50,000 | | |
| Martin White | 3 | 75,000 | | |
| North Sierra Nevada | | | | |
| North Bonanza | | | | |
| New York | | | | |
| Nevada | | | | |
| Northern Belle | 1 | 25,000 | 4 | 160,000 |
| North Belle Isle | 2 | 40,000 | | |
| Navajo | | | 5 | 125,000 |
| North Gould and Curry | 2 | 55,000 | | |
| Occidental | | | | |
| Original Keystone | 1 | 30,000 | | |
| Original Gold Hill | | | | |
| Ophir | 2 | 252,000 | | |
| Overman | | | | |
| Prospect | | | | |
| Pioneer | | | | |
| Phil Sheridan | | | | |
| Potosi | 3 | 140,000 | | |
| Paradise Valley | | | | |
| Phœnix | | | | |
| Real del Monte | | | | |
| Raymond and Ely | | | | |
| Richmond | | | 3 | 270,000 |
| Savage | 3 | 168,000 | | |
| Senator | 1 | 10,800 | | |
| Scorpion | 2 | 20,000 | | |
| Seg Belcher | | | | |
| Silver Hill | 2 | 10,800 | | |
| Sierra Nevada | 3 | 300,000 | | |
| Solid Silver | | | | |
| South Utah | | | | |
| Silver Prize | | | | |
| Star | 2 | 20,000 | | |
| Trojan | | | | |
| Tuscarora | | | | |
| Union Consolidated | 4 | 250,000 | | |
| Utah | 4 | 80,000 | | |
| Ward | | | | |
| Yellow Jacket | | | | |
| Wales | 1 | 25,000 | | |
| Total | | 4,269,940 | | 644,000 |

Since the decline in the yield of the Comstock lode and the falling off in the mines in Eureka district, mining in Nevada has not attracted the attention of former years.

The record of mining during 1883 presents many changes in the relative production of the various mining camps and districts of the State. Larger amounts have been obtained from the Comstock lode in cleaning out from the neglected upper levels ore which in the palmy days of that famous district would have been considered of too low grade to be profitably worked. Large expenditures continue to be made in exploiting and following this lode to its lowest depths. The 3,100-foot level has been reached, but no valuable ore-body of sufficient richness to pay for its extraction was discovered. The money to prosecute this work was obtained principally by assessing the stockholders.

The mines of Elko County yielded nearly $50,000 more than the previous year, but not equaling its former production.

In Esmeralda County, by reason of adverse litigation, the Northern Belle mine suspended operations during a portion of the year, and consequently exhibits a diminished production of over $400,000, while the other mines in Candelaria have largely increased their production.

In Eureka County the total production of bullion, including lead, has fallen off quite one-third, although there has been an increase in the yield of the Richmond mine. This great decline has resulted from diminished work in the Eureka Consolidated, which reported 22,356 tons, of the value of $990,013, worked in 1882; but only 9,512 tons, of the value of $205,564, in 1883.

In Lander County the mines seem generally to be in a prosperous condition, the expense of extracting the ore being more than covered by the value of the bullion. The production of Lander County for 1883 exceeded that of 1882 by over $300,000, the principal part of which resulted from the increased production in the Manhattan, Lander, and Paxton mines.

The prospects in Tuscarora district are brighter than heretofore, and many of its mines are making satisfactory returns to investors and owners, as well as paying dividends to its stockholders.

In White Pine County, the Star mine shows a diminished yield of over $100,000. The Paymaster, however, which made no report to the assessor in 1882, shows for 1883 bullion worked to the value of nearly $110,000.

The building of trunk lines of railroads north and south of the boundary has opened for settlement many new sections of the State. The further extension of these roads will revive and stimulate mining in many localities which in the past have suffered from misrepresentations as to the value of the different mines, as well as from the incompetency of those intrusted with their management, and the present lack of interest in mining resulting in part from these causes will in a measure be evercome.

The Carson and Colorado road, extending, as it does, through a large portion of Esmeralda County, will greatly tend to develop its paying mines, many of which are already well equipped with works for the reduction of ores and some have during the past year commenced work.

The production of this section for the year is shown by the shipments over the above-named road to have been as follows:

| | Tons. |
|---|---|
| Ore | 25,165 |
| Copper and lead bullion | 246 |
| Salt | 2,763 |
| Grain | 749 |
| Borax | 2,203 |
| Borate of lime | 450 |
| Soda | 287 |

Following the eastern slope of the Sierra Nevadas, this road will in the near future traverse the many productive farming and grazing valleys watered by the Carson, Walker, and Owens rivers and their tributaries, and afford cheap transportation facilities, not only for their supplies, but also for the mineral product of Esmeralda County.

## CHURCHILL COUNTY.

The production of this county has increased somewhat during the past year, and the outlook is encouraging.

Mr. Lindley, who has control of several of the mines of Churchill County, finding the expense of treating the ore too great to admit of profitable working, leased them to the English mill at Reno, where their product has been treated at a largely reduced cost.

From five of these mines 40 car-loads of ore per day have been shipped to the mill, at a cost per ton for—

| | |
|---|---|
| Mining | $4 00 |
| Railroad freight | 2 60 |
| Hauling from station | 3 10 |
| Milling | 3 00 |
| Total | 12 70 |

The ore assays from $15 to $100 per ton. Fifteen men were employed at the mill and thirty-five at the mines.

*Bernice district* is in the northwestern part of Churchill County, about 65 miles west of Austin, and the same distance east from Lovelocks. The district contains several small productive mines, which in the aggregate give employment to abont fifty men.

The principal mines which have been sufficiently developed to prove their valne are the Golden Crown, owned by Wallace Goodall, the Silver Ridge, and the Wild Goose. The last-named mine has produced sufficient ore to keep its mill in constant operation. The total yield of these three mines during 1883 was reported at $106 gold, and $14,723 silver.

Mr. Wallace Goodall has furnished the following report upon this district:

During the past year a good deal of work has been done on the Golden Crown, Wild Goose, and Silver Ridge ledges in the way of development and shipment of ores. A 5-stamp mill is being erected and has all of the machinery in, including a Buckner furnace, but the mill is not inclosed as yet, and consequently will not run again until spring. Ninety tons of ore were worked from the Golden Crown mine, which yielded $55 per ton in silver and a small per cent. of gold. This ore is free-milling, and is treated for $15 per ton.

The Wild Goose Company have had 54 tons of ore worked, which yielded a little over $100 per ton. This ore is base, containing hematite iron and antimony, and requires roasting. They have 75 tons of second-class ore on the dumps that will average $50 per ton, but it will not pay to reduce it at the mill, as the prices for milling base ores are so exorbitant—$35 per ton and guarantee to 85 per cent. of assay value. The Utah claim has an incline down 100 feet; have out 40 tons of ore that will average $70 per ton.

The owners of the Hidden Ruby and Bernice ledges are opening their claims, the ores of which average $60 per ton in silver and $10 in gold. The Hidden Ruby ores contain from 10 to 23 per cent. of horn or chloride of lead and require roasting. Seven miles south of the mill a promising claim has been discovered and called the West Point. The ores are a chloride, will average $100 per ton in silver, and the ore veins average 16 inches in thickness; formation, granite and porphyry.

Bernice district requires leaching works in order that its base ores, running from forty to seventy dollars per ton, can be economically treated.

The Silver Ridge Mining Company ship their ores to Salt Lake for reduction, the ore being easily and cheaply reduced.

In *I X L district* very little has been done during the past year except assessment work. The Old Bolivia or Table Mountain nickel mines are being worked with a small force of men, but the mines cannot be successfully worked without the erection of works for the reduction of the large masses of low grade ores which will not pay to ship.

*Table Mountain district.*—Mr. George Lovelock writes that veins of nickel and cobalt carrying ore assaying from 10 to 39 per cent. of nickel have been discovered in this district, and several claims have been located with flattering prospects of proving valuable mines.

*Desert district.*—Mr. Walter Schmidt, of White Plains, Churchill County, sends the following report of the mines of Desert mining district:

" They have done better this year than previously, and, as they now are in the hands of parties who have the means to work them, good returns may be expected. The intention is to commence operations in the spring of 1884, and reduce the ores either at the Churchill Mill and Mining Companies mill, situated 3 miles from the mines, or at the Oneida mill, run by water-power at the outlet of Humboldt lode. The machinery in the former mill being defective, the owners of the mines have been shipping their ores to the English mill, at Reno, at the rate of 12 tons per day. It averages about $20 per ton in gold and silver and the bullion is worth about $1.50 per ounce. Total amount of bullion taken out this year, $20,000."

He estimates the yield of the Equitables, Imperial, and Gold Hill mines in Desert district at $15,000 gold and $5,000 silver; total, $20,000. The Churchill Mill and Mining Company were assessed upon 289 tons of ore extracted, giving a gross yield of $1,452.

I have estimated the production of this county for 1883 as: Gold, $5,000; silver, $20,000.

## DOUGLAS COUNTY.

The assessor does not report any production in this county. Wells, Fargo & Co., however, report shipments and the mint that it received deposits from other sources, the total carried and received at the mint being $9,738.

I have not estimated any production for this county, as its product, if any, cannot be well separated from that of adjoining counties in which it is included.

## ELKO COUNTY.

There was a slight increase in the production of this county over the previous year, showing a healthy condition of its mining industries.

*Tuscarora district.*—A greater amount of ore was taken from the Independence mine this year than in 1882. It was extracted from a narrow seam above the 300-foot level, but although considerable work has been done in driving the cross-cuts and drifts in the vicinity of the ore chute, nothing further has been discovered. On the 300-foot level the main drift north was extended 380 feet. The ore was treated at the Navajo mill at a net cost of $25 per ton, obtaining 93 per cent. of the assay value. The Independence, Navajo, Belle Isle, North Belle Isle, and P. and P. mines are all owned by one company and under one management.

The Navajo mine has made many important improvements, involving considerable expense, and is now well provided with all machinery and appliances required for the next three or four years. The steam-power and pumps are considered amply sufficient to handle three times the amount of water likely to be encountered. The main shaft was sunk 200 feet to the 650-foot level, the lowest point reached in the mine. At this level two cross-cuts have been extended, the one on the east 70 feet to reach what is known as the east vein, and the other west 40 feet to strike the west vein. These veins are nearly 500 feet apart, and, according to the surface surveys before reaching ore, the cross-cuts must be run—the east cross-cut 250 feet and the west 125 feet. At the 450-foot level the vein has been drifted upon 300 feet each way from the shaft and found to be strong and well defined, varying in width from 1 to 5 feet. The north drift has been extended to the Navajo and Belle Isle boundary line. No stoping was done on this level, the bulk of the ore treated during the past year having been taken from between the 350 and 250 feet levels. A considerable body of ore still remains between the 250 and 150 levels. No stoping has been done on the latter, though drifts have been run on the vein at this level for the entire length. The Navajo ten-stamp mill also does custom work, but during the summer an average of $73,000 was sent out each month and $200,000 paid to stockholders in dividends.

The assessor reports the bullion product of the Navajo and Independence mines at 2,693 tons, of the value of $430,458, which exceeds the value of their products in 1882 by $110,000.

According to the published statements the mine produced bullion as follows during the first six months of 1883:

| | |
|---|---|
| January | $80, 000 |
| February | 64, 450 |
| March | 68, 750 |
| April | 83, 880 |
| May | 61, 823 |
| June | 12, 000 |
| Total | 370, 903 |

The yield in June had fallen to $12,000, and averaged for the last six months barely $10,000 per month.

The Argenta mine has been worked under the superintendence of Mr. John E. Dixon, who says:

"At present we are doing but little work in the Argenta, merely running a cross-cut south on the 400-foot level. We found a very small body of ore below the 600 level, but it did not amount to anything, producing but $15,022.39 in bullion. The hoisting works were burned June 29, 1883, and, as the lower levels are all flooded, the work of prospecting will have to be confined to the upper ground. The prospects at present are not as encouraging as I would like to see them, still we may at any time encounter a body of ore, as the ground here is full of seams."

He also states in regard to the Grand Prize mine:

"At present we are only working in and above the 400-foot level. Last fall in drifting south in the 400-foot level we found a ledge running at right angles with the old chimney of ore first found in the mine, and have, during the past few months, been milling some ore from it. It is a very fair prospect and improves as we raise upon it; also, as we go south, so that by winter it can be thoroughly opened up. The ore has so far paid a small profit over all expenses.

"In the 300-foot level, north and parallel to the old ledge, we found another ledge which has some very good ore in it, but it is a small vein. Outside of these two places no work is being done, although we have over 900 feet of ground west that has not had any work done on it which we expect to prospect this winter. Last year we produced in bullion but $55,715.96, but expect next summer to do well. I cannot give you the value of gold and silver, as we ship our bullion crude, and my figures may vary a little from the result after assaying."

On the Elko Consolidated mine work was chiefly done on the 200-foot level and on shaft No. 2.

The Basin and Sheet Anchor mines were not worked for a part of the year; the Basin mine for a want of water, and the Sheet Anchor on account of the shaft being flooded.

*Good Hope district.*—In this district there has been a gradual development which has made it a promising region. Fifteen men are engaged in mining.

In the Consolidated Buckeye mine the shaft has been sunk 50 feet, and 150 tons of ore extracted, ranging in value up to $300 per ton.

From the Patience mine three men are taking out considerable high-grade ore.

The Golden Era mine is producing fine ore from a ledge, which, though narrow at the surface, widens as it goes down.

The Big Muddy has a shaft 60 feet deep, and at the bottom high-grade black sulphuret ore is found which assays from $100 to $900 per ton.

*Railroad district.*—A smelter has been erected near Railroad, and several car-loads of bullion have been shipped from it to the Bank of California.

The approximate value of the bullion and matte thus far turned out by the furnace is $36,000.

The assessor's returns for Elko County show the production and cost of operating the mines during 1883 to have been as follows:

| Name of mine. | Ore extracted. | Gross yield. | Total cost. |
|---|---|---|---|
| | *Tons.* | | |
| Grand Prize | 646 | $55,815 96 | $44,357 56 |
| Navajo Independence | 2,693 | 430,457 80 | 228,337 43 |
| Edward Reily | 700 | 25,200 00 | ............ |
| Argenta | 185 | 15,022 39 | 12,073 00 |
| Total | 4,224 | 526,496 15 | 284,767 99 |

The amount carried by Wells, Fargo & Co. from this county during the same year, together with that deposited at the mint from private sources, amounted to $575,163. I have estimated the production at $580,000, of which $30,000 was gold.

## ESMERALDA COUNTY.

The principal mines of Esmeralda County have yielded much less in 1883 than in the previous year. The quantities worked and the gross value for those years compare as follows:

| Years. | Ore worked. | Gross value. |
|---|---|---|
| | *Tons.* | |
| 1882 | 36,509 | $1,372,228 53 |
| 1883 | 20,121 | 898,158 93 |
| Decrease | 16,388 | 474,069 60 |

I am indebted to Myles J. Anson, M. E., Mr. A. G. McKenzie, W. P. McIntosh, C. Novacovich, J. T. Wilson, and O. C. May for much valuable information concerning the mines in the different districts of Esmeralda County.

During the year the Princess, Mount Potosi, Victory, Enterprise, and Vanderbilt mines remained idle.

The *Columbus mining district* remains for another year the largest producer of bullion in Esmeralda County. The prominence of this district is chiefly due to the Northern Belle mine, which, since May, 1875, has shipped bullion to the amount of $10,000,000, and paid to its stockholders before ever levying an assessment not less than $5,000,000.

The Northern Belle mine.—During the year this mine has yielded 19,573$\frac{1920}{2000}$ tons of ore, and its gross bullion product has been $763,939.32. The main shaft reached a depth of 800 feet in September. On the fifth level the drift was extended 250 feet to the west, where a winze was sunk 120 feet on an incline through soft black slate streaked and spotted with sulphurets. From the foot of the winze a cross-cut was run 97 feet, when the intense heat obliged work to be suspended. On the main level above a drift was run southwest 198 feet through a small vein of sulphurets assaying at $200 per ton. On the fourth shaft level the main drift was run westward 221 feet through low-grade sulphurets. Drifts to the length of 500 feet and cross-cuts of 351 feet have been made on this level, and an upraise of 77 feet and a winze of 69 feet have been made for ventilation. On the third level, drifts have been run 525 feet, cross-cuts 368 feet, and a winze of 98 feet and one of 60 feet have been sunk. On the second level, 230 feet of drifts and 62 feet of cross-cuts, an upraise of 108 feet, and one of 60 feet, and a winze of 110 feet have been made. On the first intermediate, 110 feet of drifts and 217 feet of cross-cuts were run. The main drift was extended 447 feet westward, and 312 feet of cross-cutting and winzes to the depth of 199 feet were made. On the upraise from this level a fine body of ore was found, and in developing and extracting it 265 feet of drifts, 201 feet of cross-cuts, and 70 feet of upraises were made. On the eleventh level explorations were made by means of 530 feet of drifts, 388 feet of cross-cutting, two upraises and one winze. On the ninth level an extensive body of soft chloride was found and yielded largely for nine months before being exhausted. In running a tunnel from the outside, 80 feet above the seventh level, a body of ore was found averaging $45 per ton. For a few months one of the mills was closed, running on half-time, but for the rest of the time until December they were running on full time, with one hundred and fifty men employed and doing a great deal of custom work.

In October the suit of the Holmes Mining Company, whose claim adjoins the Northern Belle mine, was tried in the United States district court for the district of Nevada, Judges Sawyer and Sabin presiding. The Holmes Company suit was for trespass and damages and asking for $1,500,000 in compensation for ore taken from their claim. The jury gave a verdict for the Holmes Company for $360,000, and the Northern Belle Company immediately closed their works, wound up their affairs, and advertised the property for sale. The Holmes Company having acquired it, work will soon be resumed.

The following was the financial statement of its affairs for the year:

### RECEIPTS.

| | |
|---|---|
| Bullion, 463 bars, Nos. 5279 to 5741, gross value, $855,988.18, less the deductions (which includes freight by express, mint charges, and discount on silver), $136,348.32 | $719,639 86 |
| Crushing ores for outside parties | 77,453 11 |
| Spring—sale of water | 239 28 |
| Drafts outstanding and unpaid September 1, 1883, constituting our entire indebtedness | 22,586 58 |
| Cash on hand September 1, 1882, $135,972.86, less drafts outstanding at that date, since paid, $23,719.60 | 112,253 26 |
| W. V. Price, superintendent, balance in his hands September 1, 1882, since paid | 54 59 |
| | 932,226 68 |

### PAYMENTS.

| | |
|---|---|
| Dividends—eight—Nos. 64 to 71, of $25,000 each, equal to 50 cents a share | $200,000 00 |
| General expense at San Francisco, including salaries, surveying, legal, &c | 57,060 79 |
| General expense at mine | 9,097 72 |
| Interest, exchange, &c | 41 98 |
| Insurance ($60,000 on each mill) expires March 14, 1884 | 4,474 65 |
| Mine expenses | 229,210 53 |
| Mills (two) expense | 253,268 23 |
| Ore tax for the quarter ending March 31, 1883 | 6,998 19 |
| Ore purchases | 66,843 97 |
| W. V. Price, superintendant, balance in his hands September 1, 1883 | 50 89 |
| Supplies and materials forwarded | 30,679 23 |
| Taxes (Nevada and California) | 3,308 22 |
| Cash on hand September 1, 1883 | 71,192 28 |
| | 932,226 68 |

### RECAPITULATION.

| | |
|---|---|
| Cash on hand September 1, 1883, as shown above | $71,192 28 |
| Deduct drafts outstanding all told, to September 1, 1883 | 22,586 58 |
| Actual cash balance, September 1, 1883 | 48,605 70 |

### INVENTORY AND VALUE OF PROPERTY AT MINE AND MILLS AUGUST 31, 1883 (ALL PAID FOR).

| | |
|---|---|
| Land at Belleville (60 acres) | $200 00 |
| Land at mine (5½ acres at shaft) | 25 00 |
| Improvements at Belleville (two mills, furnaces, &c.) | 356,850 00 |
| Improvements at mine (hoisting works, &c.) | 25,050 00 |
| Supplies at mills | 17,408 30 |
| Supplies at mine | 10,969 86 |
| Water-works | 25,000 00 |
| Oats and hay | 107 25 |
| Total valuation | 437,410 41 |

Columbus Consolidated mine.—During the past year new hoisting works have been erected and a double compartment shaft has been sunk 315 feet towards the old workings. The old Bonanza winze was sunk to the 150 level and drifts were made to the east and west, encountering bodies of good ore in either direction. A station was established on the third level and a drift of 175 feet run towards the Bonanza winze. A new stope, near the mouth of this winze, has produced good ore for some time. A more perfect ventilation has been secured by the new shaft, and its connections and stations are being excavated on the fourth and fifth levels. Three shifts of eighteen men were employed.

The Doran mine.—This property, formerly known as the Nevada and the Lo Yolo mine, has been bought by New York capitalists, and by means of a Howland pulverizing machine it is expected that a profit will soon be realized from its ores.

Mount Diablo mine.—During the past year but little work was done in exploring and developing the mine, except such as was necessary in extracting the ore already found. Rich ore was taken from the drifts on the first, second, and third levels, and in December, while the machinery was being repaired, the shipping and extracting of ore was discontinued and prospecting was carried on by a cross-cut from the bottom of the shaft extending 315 feet; the object of this cross-cut being to prospect in depth the ground of the Peru, Tipton, Stump, and Adams ledges. Seventy men were employed in the mine, and on December 31 a shipment of bullion amounting to $16,537.28 was made. The deepest stope worked was the stope below the third level between winzes No. 1 and No. 2, and is 500 feet below the collar of the shaft and 160 feet west of it. It yielded considerable $75 ore and some of much higher grade. On the stope above the west drift from the Callison winze the ore was in a body from 100 to 140 feet long. It was worked for 110 feet on the dip, and in the widest place there were 12 feet of $200 ore. The stope has yielded 3,700 tons of ore and will probably yield more. Several hundred tons of ore have been taken from the old workings near the Mount Diablo adit. By the use of the Mount Cory Company's leaching process a higher percentage might be realized from the ores than by the process now in use.

The company's annual report shows a production of bullion valued at $441,518, from the 18th of December, 1882, to the 1st of December, 1883.

The following is a summary statement of the operations, receipts, and expenditures during the year:

| | | Tons. |
|---|---|---|
| Ore on hand November 30, 1883 | | 400 |
| Ore extracted during the year | | 8,027 |
| Low-grade ore shipped to mill this year, but extracted in former years | | 375 |
| Total | | 8,802 |
| Amount sent to Belleville | | 8,029 |
| Amount of ore at mine | | 773 |
| Amount of ore sent to mill | 8,029 | |
| Amount of ore milled | 7,847 | |
| Amount of ore at mill | | 182 |
| Total amount on hand November 30, 1883 | | 955 |

RECEIPTS.

| | | |
|---|---|---|
| The financial statement shows cash on hand December 18, 1882 | $10,478 07 | |
| Bullion | 441,157 62 | |
| | | $451,635 69 |

DISBURSEMENTS.

| | | |
|---|---|---|
| Mine supplies | $7,418 55 | |
| Labor at mine | 104,519 65 | |
| Transportation of ore | 18,467 32 | |
| Freight | 2,965 75 | |
| Bullion tax | 3,857 31 | |
| Milling | 117,705 00 | |
| Bullion discount | 75,534 53 | |
| Express charges on bullion | 4,748 90 | |
| Water | 2,098 38 | |
| Wood | 3,037 98 | |
| Dividends—1, 2, 3, 4 | 50,000 00 | |
| General expenses | 10,935 68 | |
| | | $401,339 05 |
| Cash on hand November 30, 1883 | | 50,296 64 |
| Gross value of unsold bullion in Bank of California | 46,460 87 | |
| Discount, estimated at 17½ per cent | 8,130 65 | |
| | | 38,330 22 |
| Total surplus | | 88,626 86 |

On the Holmes mine a small force of men have been at work during the year.

The Lucky Hill, with a force of four men, and the Great Eastern, with six men, have been worked during the year.

At the Enterprise mine sixty-five men were at work, and the furnace was worked successfully for six months.

*Esmeralda district.*—There has been comparatively little mining done this year in this district, which was one of the first discovered by the prospectors in 1859. During the years 1860, '61, '62, '63, the Pond, Del Monte, Wide West, Antelope, Utah, Young America, Esmeralda, and other mines produced over $14,000,000 in bullion. Nineteen mills were in active operation working 196 stamps, and the rich ore was all taken from near the surface. The ore was found in pockets or chambers much of it yielding $1,000 to the ton in the rude mills of that time. At a depth of 150 feet a barren zone was struck in the mines on Last Chance Hill, and unfortunate litigation with the Pond, Del Monte, and other properties caused a reaction. At this time the discovery of the Comstock mines and the Reese River district drew off the miners and prospectors to the new fields.

The district is about 3 miles in length by 1 in width, the formation is porphyrytic, the veins are large, well defined, and no doubt true fissures, having a northeasterly and southwesterly direction, with a dip or underlie to the east. Some veins in the district have been worked to the depth of 400 feet, and are easily traced through the porphyrytic formation for 3 miles, dipping under the vast glacial deposit. On the south the same veins crop out again at Bodie, where the resemblance to the Aurora ledges is apparent. Three miles north of this district there is another outcropping of the same ledges. The only deep mining ever attempted in the district was by the Junietta and Real Del Monte companies. At the depth of 800 feet they encountered so much water that even with the use of a 16-inch pump they were unable to continue work.

I am indebted to Mr. C. Novacovich, of Aurora, for much of this information and for the following estimate of the total bullion product of these mines:

| | |
|---|---|
| Cortez Gold and Silver Mining Company | $25,000 |
| Centennial Gold and Silver Mining Company | 15,000 |

| | |
|---|---|
| Silver Lining Gold and Silver Mining Company | $2,080 |
| New Esmeralda Gold and Silver Mining Company | 1,620 |
| Coasters or ore gathered promiscuously | 8,000 |
| Total | 51,700 |

Mr. W. P. McIntosh estimates the production of the district as follows:

| Producing mines. | Gold. | Silver. | Total. |
|---|---|---|---|
| Cortez | $7,842 21 | $5,088 80 | $12,931 01 |
| Centennial | 5,000 00 | 1,000 00 | 6,000 00 |
| New Esmeralda | 750 00 | 200 00 | 950 00 |
| Quincy | 1,000 00 | 200 00 | 1,200 00 |
| Lewis Consolidated | 300 00 | 100 00 | 400 00 |
| Total | 14,892 21 | 6,588 80 | 21,481 01 |

The Cortez mine.—This mine has a depth of 400 feet, and during the year produced 500 tons of ore.

The Centennial mine lies parallel to the Cortez mine and 100 feet east. A shaft has been sunk 400 feet on the underlie of the vein and a drift run south from it 150 feet on the ledge. The backs have been stoped for some distance, producing ore that yields an average of $50 per ton.

The Silver Lining mine is on Humboldt Hill, where the ledge is strong and well defined, and crops out for a distance of nearly 1,500 feet in length, with a width of 20 feet and a height of 12 to 15 feet. A shaft has been sunk for 60 feet on the ledge, and the ore taken out averages $32 per ton.

The Humboldt West Mining and Milling Company owns a claim 1,500 long and 200 feet wide on the Humboldt lode, and has erected a twenty-stamp mill for working their ores.

The New Esmeralda mine is situated on the ledge 3 miles north of the Humboldt mines, and the company owns a block of ground 3,000 feet in length by 1,200 feet in width, which is crossed transversely by six large veins. The ore yields gold and silver at an average of $27 and $33.50 per ton.

The Lost Indian mine has made important developments during the year. A 3-foot vein of gold and silver bearing quartz was cut, the ore averaging $100 per ton.

The Central mine, near the Lost Indian, has developed a 4-foot vein at a depth of 20 feet, the ore from which assayed at $20 per ton.

On the New Discovery claim ore was found yielding $200 and $700 per ton.

The Mount Cory mine.—This mine, of which only passing mention was made in 1882, has since been bought by J. C. Flood, J. L. Flood, George R. Wells, and Alexander Mackenzie. The purchase price was $16,000.

Being possessed of abundant means, the owners are developing the property systematically and with a view to permanency. A new mill has been built at a cost of $150,000, the building and wings covering an acre of ground. The mill holds a revolving crusher, a Brockner furnace, Stedefeldt dryers, and the most improved models in all the apparatus for treating the ores. In November, when the mill was opened, the ore was ready for the miners on six levels and the track was being laid from the mine to the ore-house. In addition the Mount Cory Company erected a prospecting mill and roasting furnace for the express purpose of testing the value of other ores, and developing the process by which they can be worked to the greatest advantage. The reduction works are the most extensive in the State.

The Elna mine was compelled to suspend work in December on account of an accident to the furnace. The Elna Company has bought the old Montezuma mine and have sunk a shaft 300 feet and run a tunnel 200 feet to the ledge, which is yielding rich ore.

The Peacock mine has developed a ledge of nickel 50 feet in width with walls well defined and traces of copper in the ore.

The Silver Peak mine shipped an unusual amount of bullion this year, and the Silver Cup and the Silver Wave mines were ranked among the good locations.

In Lida Valley the Morning Star mine found ore worth $207 per ton in its eastern extension of the Death Valley lode.

The Pontiac mill worked ores from its own mine worth $377 per ton, and crushed ore from the other mines in the valley.

High-grade ore from the North Star mine sent to San Francisco gave $1,320 per ton; that from the Morning Star, $750; and that from the Sewana $1,355 per ton.

Mr. Myles I. Anson contributes the following concise report upon the mines of the Santa Fé district:

"*Santa Fé district* lies immediately north of Luning, on the Carson and Colorado railway, and covers the Gillis or Volcano Mountain range, bearing within its limits notable deposits of silver, copper, iron, antimony, and sulphur. The formations are chiefly metamorphic schists and limestones, with extensive porphyritic and primitive obtrusions. There occurs near Volcano Mountain, a few miles from Luning, a well-marked zone of fossil-bearing rocks prolific in organic remains of the Lower Silurian series, the most numerous forms of which are sisserkite, orthoceratites, and various bivalves.

"The silver-bearing lodes of the district are numerous, carrying ores generally of high grade and of smelting character; but a majority are prospects only of more or less promise, and as yet but little opened for systematic mining. The recent completion of the Carson and Colorado Railway has, however, raised the bar of heavy freight rates, and opened outlets for ores heretofore unprofitable.

"Prominent among the silver properties of Santa Fé is the Tip Top mine, 8 miles north of Luning, which is well opened by tunnels, and yields chloride ores of paying quantity and grade.

"The Sunrise, contiguous to the above on the west, is a property well exploited by shaft and tunnels, and notable as a prolific bullion producer in past years, but at present measurably idle in consequence of partnership difficulties, litigation, and the presumed exhaustion of the rich discovery ore body. Recent work, however, reveals the continuance of very rich ore in the unbroken lode beneath the old workings, and an important future may be predicted for this mine. There are at present on the dump some 200 tons of the second class mixed milling and smelting ores, which are sampled to run $50 to $100 per ton in silver.

"The Menzie and Dunlap, 12 miles northeast of Luning, is a wide and permanent lode, sufficiently explored by tunnels and cross-cuts to prove it a valuable silver depository. The ores are of low grade, averaging $30 per ton, but of free-milling character and practically inexhaustible.

"The Yellow Jacket, a contact vein between lime and syenite, at the extreme western end of the district, is being actively worked with profitable results, the galena ores from it yielding about $150 per ton.

"In the Nellie mine, on Volcano Mountain, 5 miles north of Luning, only exploratory work is at present being done, with the incidental extraction of occasional lots of ore in the search for the main fissure. The formation is siliceous limestone; the ores mainly chlorides, with admixture of galena. This mine in former years shipped considerable quantities of high-grade ores to Swansea.

"Among the notable copper mines of Santa Fé district is the Copper King, 6 miles north of Luning, which, in the width of its ore-channel, its accessibility, and the uniform and amenable character of its ores, has hardly a parallel.

"The Copper King has an average vein width of 60 to 80 feet, courses southeast by northwest, and carries carbonate, oxide, and silicate ores, averaging 14 to 18 per cent., through the mass of its lode from wall to wall. It is opened by shaft and tunnel, and by various cuts and open excavations, exhibiting in all the same character and quality of ore. A supply of ore for years may be quarried from the surface of this lode. Several hundred tons are already piled up, awaiting the smelting works which the company contemplate building in Soda Springs Valley, 2½ miles distant.

The Silver Star mine, 15 miles south of Luning, holds two parallel veins, running east and west, that crop out in places 100 feet deep. The ledge is one mass of copper ore, running from 10 per cent. to 60 per cent. per ton.

"The Sweet Vengeance is a massive and promising copper lode in the Dunbarton range, 9 miles north of Luning. This is a well-defined contact vein, lying between porphyry and syenite, 20 feet wide, carrying carbonate and red oxide ores of high value, a considerable accumulation of which, from the various exploring cuts in the croppings, is now ready for shipment. .

"The Stone Cabin Group, 6 miles northwest of Luning, have yielded largely in high-grade carbonate ores, which are shipped via Carson and Colorado Railway to Dayton, Nev., for reduction. The ores carry from 20 to 30 per cent. copper, and have paid liberally for the very desultory work so far done on the properties.

"In *Silver Star district* the Blue Light copper mine, near Soda Springs, on the Carson and Colorado Railway, 12 miles southeast of Luning, has a 30-ton water-jacket smelter, which, during the month of June, 1882, produced 128 tons of ingot copper, the average grade of the ores being 25 per cent. Subsequently work was suspended on account of the mine caving seriously and the contraction of the ore body. It is reported that the furnace will soon resume running on custom ores.

"In *Garfield district*, 8 miles southwest of Luning, the most noteworthy and productive silver property is the Farrington mine, which to date has yielded over $100,000, a large part of this yield being profit to the owners. The mine has no reduction works, but ships its ores to Belleville, Nev., and to the Castle Dome works at Oakland, Cal.

"The Atherton mine has one tunnel of 300 feet and one of 400 feet, exposing bodies of high-grade ore.

"In the Great Western mine not an ounce of powder has been used, and the ore averages $250 per ton.

"The Lancashire and the Henly are good mines, and the Blue Light Copper mine, after producing several thousand tons of fine ore, was closed.

"The Johl and McDonald mines remained idle.

"The Farrington mine has developed a change with depth in its metallic contents, which is phenomenal and apparently at variance with all former mining experience. The vein at the surface, and for a considerable depth, carried true silver ores, with a notable per cent. of gold associated, in a gangue mainly calcareous. At a depth of about 400 feet the gangue is almost pure quartz, the silver ores have vanished, and free gold, unaccompanied by visible sulphurets, is thickly disseminated through the clean matrix as in the specimen gold quartz of California veins. It would be of interest to know whether this change has been accompanied by any marked variation in the character of the inclosing rocks, and whether similar instances can be cited.

"In *Santa Fé district* a deposit of very pure antimony ore (sulphide and oxide), associated with silver-bearing quartzite, occurs on the southwestern face of Volcano Mountain at an altitude of 1,500 feet above Soda Springs Valley, from which a few tons have been extracted; but as yet no systematic work is done to determine its extent. This occurrence is along a line of extinct thermal springs or geysers, the vents of which are all now sealed with sparry deposits, save one, which has been explored to a depth of about 100 feet vertically.

"At an equal altitude, across a deep arroyo west of this mountain, a considerable deposit of almost pure sulphur outcrops in an extensive ferruginous dike. The mineral occurs in solid nodules and concretions from a few pounds each to several hundred weight; but beyond the extraction of a few tons in exploring work the deposit is not worked or utilized."

The bullion productions of the mines in the *Wilson mining district*, Esmeralda County, Nevada, for the year ending December 31, 1883, were as follows:

| Producing mines. | Gold. | Silver. | Gold. | Silver. | Total. |
|---|---|---|---|---|---|
| | *Ounces.* | *Ounces.* | *Value.* | *Value.* | *Value.* |
| Wilson mine | 255 | 27 | $4,600 | $27 | $4,627 |
| Wheeler mine | 100 | 10 | 1,800 | 10 | 1,810 |

Although these mines have not shipped in the past year as much bullion by several hundred ounces as in any former year, they show signs of improvement. In the Wheeler mine a large body of ore has been recently discovered. The ledge, as far as it has been developed, will average from 4 to 6 feet in width and yields about $40 per ton.

The Wilson mine, during the past year, has been opening up the lower level, prospecting, ventilating, and retimbering. The mine is in a good condition for operations the present year.

Few mines have been discovered about 30 miles northeast of this place, east of Walker River, and north of Crab district about 8 miles, the average assays from the mines being $130 per ton. As the ores carry a large quantity of base metal there has not been much work done on the mines for want of a mill and proper machinery for working the ores. Little work has been done at Cambridge or in the Crab district.

During 1883 the amount carried by Wells, Fargo & Co. from Esmeralda County, together with that deposited at the mint through private sources, amounted to $633,385. I have estimated the production to have been: Gold, $60,000; silver, $890,000; total, $950,000.

## EUREKA COUNTY.

The product of this county fell off over $1,000,000 during the past year, reducing Eureka County from the head of the list of producing counties of the State, which position it occupied in 1882, to second. The Richmond Consolidated, as usual, headed the list of its producing mines, while the Geddes and Bertrand, the Albion and Eureka Consolidated were the next in order.

*Safford district.*—The ores from the Safford district, instead of being sent to Eureka, are shipped to Salt Lake, a distance of 400 miles, and worked cheaper than at home. The Salt Lake furnaces pay full assay value for all ores, deducting $12 per ton for working charges and $8.25 for transportation from the dumps to Safford, making $20.25 the total cost of hauling and reducing. Ore assaying $26 per ton would net the owners $4.75 per ton. The Safford ores carrying so much iron are desirable for smelting Utah ores, which, without carrying much silver, makes them worth something. No more charge is made for shipping the high-grade than the low-grade ores. The furnaces in this section only pay 67 per cent. of assay value, besides charging $12 per ton for reduction, not counting transportation rates, which makes it cheaper to ship even low-grade ores to Salt Lake.

The Onondaga mine.—Development work was continued on the Onondaga, and a shaft was sunk 135 feet in ore all the way a vein 5 feet wide being found at 80 feet below the surface. At the bottom there is a different formation from the igneous rocks at the surface. The gangue is iron, but there are deposits of rich yellow carbonates and native silver that were not found at the surface. A tunnel has been run 200 feet and it is proposed to run it 300 feet farther and connect with the shaft, which will have to be sunk 100 feet to meet it. By this tunnel it will only cost 25 cents per ton to dump the ore into the cañon. Six men are at work and an advance of 5 feet is made each day. The ore being so rich and the deposit so great the company has decided to erect a mill on the Humboldt River. Sixty-nine tons of ore shipped to Salt Lake and reduced gave a pulp assay of 92 ounces per ton for the first lot and 76 ounces per ton for the second. The bullion product of the mine for the year was 356 tons, of the value of about $16,000, which was, however, less than the reported expenses in working the mine.

The Zanoli mine is situated one-half mile below the Onondaga and the ledge formation is identical with it. From the northwestern extension a tunnel has been run southerly 250 feet, passing a vein of low-grade ore 40 feet in width. Thirty-five feet from the mouth of the tunnel a winze was sunk 30 feet, all in ore. A shaft has been sunk 112 feet on the ledge, 200 feet easterly from the line of the tunnel. The ore, grew richer as the vein widened, and is carbonate of silver with a gangue of iron and sulphate of baryta, carrying from 10 to 600 ounces to the ton in silver. Traces of ruby silver are discernible, and the ore at the bottom of the shaft is similar to that found in the lowest level of the Onondaga. At a depth of 50 feet on the shaft a drift was run west on the ledge 40 feet, encountering gray carbonate ore that assays from 40 to 612 ounces to the ton. One car load of 26 tons shipped to Salt Lake pulped 72 ounces to the ton. The owners of the mine have arranged to give a certain interest in the mine to some Chicago capitalists, who will erect reduction works on the Humboldt River at a place called Garland.

The Good Luck mine developed a streak of ore 4 feet thick, assaying several hundred dollars per ton. The gangue was not quartz, but black spar, giving it a burned look, but flakes of horn silver were discernible all through it.

The Banner mine started its mill in July with 15 stamps. The ore assays from 109 to 113 ounces per ton. Forty-five men are at work in the mine and mill.

The North Star has erected concentrating works about a mile from the mine, and employs 25 men, taking out 10 tons of ore per day.

The Monarch mine developed its great ore chimney, reaching from the surface to the 200-foot level, which yielded ore to the value of $1,400,000. One thousand tons sold in Omaha for $1,000 per ton. Much low-grade ore remains on the dumps, and in the 300 and 400 foot levels ore bodies have been found as rich as those above.

In Bullion Gulch and Narrow Gauge Gulch there was great activity in mining and prospecting. A new town has sprung up, known as Orado.

*Diamond district.*—Work has been carried on in the Enterprise mine for several years, but it is only within the past year that it has come prominently to the front as one of the valuable properties of the district.

Mr. E. E. Phillips was the original owner and worker of the claim which is now incorporated as the Enterprise Mining and Irrigating Company. A furnace has been erected near the mouth of the tunnel and reduces the ores most satisfactorily. A large reservoir connecting with the springs has been built. A large quantity of ore is on the dump, and there is apparently a fine body of mineral in the mine. Thirty-five men are employed in the mine and at the furnace.

*Cortez district.*—Mr. Simon Wenbau writes that "in this district outside of the Garrison mine less work has been done than in former years. Many mine owners have allowed their mines to remain idle while they visited other districts, but many have now returned and will prosecute their mining operations with more vigor and system than heretofore. Some are running tunnels to open their mines at lower depth, and will doubtless be remunerated for this work. The district is divided by the line between Eureka and Lander Counties, all the mineral belt lying east of the line, in Eureka County. The district is situated 30 miles from Beowawe station on the Central Pacific Railroad.

"Garrison mine, which has always been an irregular pipe or chimney of ore, is now opening into a more regular deposit and seems to be forming into a regular fissure vein with well defined foot and hanging walls running nearly north and dipping east at an angle of 30°. A new ten-stamp mill with three Broekner chloridizing furnaces will be erected in the spring a half mile from the mine. This will diminish the expense of reducing the ores, as heretofore they have been hauled 11 miles and treated in an incomplete manner at a mill built in 1864. The present developments of this mine promise a large and well defined body of high-grade ore. Less ore was extracted in 1883 than in 1882, and the total value of its bullion product, including lead, was only three-fourths as much, or $173,150.61."

*Mineral Hill district.*—Mr. B. L. Plummer states that the bullion product of the district was light in 1883 on account of litigation in which the Christie Mining Company was involved. A compromise, however, has been effected, and it is believed that next year the output of the district will fully equal that of former years.

The Christie Mining Company, are working the North Grand, Austin, and Spencer mines of Mineral Hill. A fifteen-stamp mill is working tailings at the rate of 35 tons daily. There are upwards of 30,000 tons of tailings in the gulch averaging 60 per cent. in value. Twelve tons were shipped to the Geddes & Bertrand mill and subjected to the leaching process, which, proving successful, the company propose to erect works of their own, as the tailings assay from $15 to $40 per ton.

Mr. Plummer gives the following as the production of one group of mines:

| Names of mines. | Gold. | Silver. | Total. |
|---|---|---|---|
| Silver Reef | $500 | $3, 352 | $3, 852 |
| North Giant | | 20, 000 | 20, 000 |
| Spencer | | 16, 000 | 16, 000 |
| Austin | | 12, 000 | 12, 000 |

*Bullion district.*—Mr. Simon Wenbau writes that "the Bullion district is situated 16 miles west from Cortez and 20 miles southwest from Beowawee. The ores run from $300 to $700 in silver and about $9 in gold, and carry 10 per cent. in lead. The Silver Sides mine has been the principal producing mine in the district. The vein has been small and irregular, but carries ores of high grade in silver, and is now giving promise of greater production. A ledge has lately been struck averaging from 9 to 14 inches in width and assaying $450 per ton.

"The Lady of the Lake mine gives promise of being a valuable and well defined lode, carrying silver ore of high grade and in considerable quantity, and so far as developed has every appearance of being a fissure vein. A ten-stamp mill and Brockner furnace have been built and everything is being done to make it a desirable mining and milling property.

"The other principal mines are the Ivanhoe, Miners' Home, Radow, and Rainbow, all of which promise well."

*Limestone district.*—This new camp, south of Beowawee, adjoins Bullion, where new mills and smelters are being erected. Limestone mine No. 1 is owned principally by railroad employés, and a contract has been let for a shaft 100 feet deep on an extension of the property. The original shaft, some 100 feet, shows galena ore assaying $100 per ton in silver and carrying 60 per cent. of lead from the surface down. The 25 tons of ore extracted in sinking the shaft paid all expenses in prospecting the mine.

*Schroeder district.*—The Schroeder district is 12 miles west of Carlin and 13 miles north of the Central Pacific Railroad. The ores, similar to those of Eureka, are continuous with the belt in Elko. Rich deposits of copper ore and nickel have been discovered, in addition to the lead carbonates, assaying high in silver. The principal mines are the Pride of Nevada, Chicago, Sandy Jim, Comstock, Yankee Doodle, and Grace Darling. Nearly all are being worked by Chicago capital.

The Grace Darling and Yankee Doodle have a mass of ore from 100 to 150 feet across, and each is sinking a shaft. The ore contains carbonate, chloride, and oxide, and assays from $100 to $1,000 in silver per ton, with very little gold, and from 10 to 20 per cent. lead and 1 to 2 per cent. copper. The Grace Darling shaft is down 15 feet, with 500 sacks of ore ready to ship, and at the bottom the ore is more solid than at the top. The Yankee Doodle shaft is 600 feet northwest of the Grace Darling, and encounters the same quality of ore, some of it being "bees-wax ore."

*Pinto district.*—In the Silverado mine fine seams of ore have been found on the 400 foot-level, and it is said that 120 tons of $100 ore was shipped to Eureka in one week of September. The mine is being worked carefully and thoroughly.

In the Queen mine prospecting is being done, and hopes are entertained of striking another rich vein.

On the Fair Play mine the ore is steadily improving, and the working force has been increased. Of 300 tons shipped to the Richmond works none assayed less than $178 to the ton, the average being $200. Three eight-horse teams, carrying 7 tons each, make the round trip of 17 miles to the reduction works and back in two days. Seven men are working the mine.

The Nahant mine is being prospected by a new tunnel.

The Rescue, Silver Stone, and Champion mines have been worked by tributers during the year, and some rich ore extracted.

*Eureka district.*—The Richmond Consolidated mine, owned by London capitalists, comprises twenty-three locations on the northern and northwestern slopes of Ruby Hill. It was sold in London twelve years ago, and by skillful and thorough management it has paid dividends during this time aggregating nearly $3,000,000. The shares command a premium of 30 per cent., and by its steady production claims to have made one of the best records of any mine west of the Rocky Mountains. According to the assessor's returns its bullion product for the year 1883 was greatly reduced, being 7,783 tons, valued at $154,477, against 30,456 tons, valued at $873,749, in 1882. With one 40-ton and one 80-ton furnace they were reducing from 120 to 150 tons a day in November. Water on the lower levels greatly interfered with the workings. At the annual meeting in London, December 19, it was reported that the general furnace had been running steadily for six months. The result of the half year's work was 7,726 ounces of gold, 220,063 ounces of silver, and 1,704 tons of lead. The profits of the half year were $65,000, and the last dividend of 5 shillings per share was paid from the half-yearly earnings without trespassing upon the reserve fund.

The Eureka Consolidated Mining Company.—All the ore found in this mine was encountered between the quartzite and shale. On the seventh, eighth, and ninth levels these two formations were from 600 to 800 feet apart, and in some places on these levels ore was found all that distance. On the tenth level the shale and quartzite began to come together, and at the twelfth level they were only a few inches apart. It was thought by many that the bottom of the mine had been reached, but an additional 100 feet were sunk on the quartzite, and at the thirteenth level a drift was started, and when in a short distance it was found that the quartzite and shale had taken a turn somewhere in the last 100 feet, and were going away from each other, and were then 200 feet apart; while on the eleventh level the ore found was not of a very high grade, and on the twelfth level hardly any was found. On the thirteenth a great deal of ore was encountered of a much higher grade than any before taken out of the mine. An additional 100 feet was sunk, and the fourteenth level was reached. Ore was found in small quantities that was very rich; but little work was done on this level, for just as they were getting ready to prospect for ore bodies there was such an increase of water that it was utterly impossible to work, and operations at the lower levels of the old works were suspended and the sinking of the Locan shaft resumed. A drift run from the 1,200 level of the Locan shaft struck the ledge at a distance of 300 feet. Some of the assays gave $40 a ton. It was feared that the water encountered in this drift was too much for the machinery to handle, but as it was considerably lowered within a short time after it was found it was proved to be the same which was pumped in the old ledge at the time that the K. K. water burst into the Eureka Consolidated mine.

Arrangements have been made with the Selby Smelting Company effecting a reduction of over 6 per cent. in the old rates of refining bullion.

A great deal of money had been lost in the erection of a large hoisting engine, which had to be condemned and another one bought in its place.

Great interest has been manifested by the people of Eureka in experimental work at this mine and in the development of its lower levels, because the permanency of their yield depends upon the extension of the ore bodies to greater depth. In drifts on the lower levels good ore was found, and it is probable that the shafts will be sunk even further.

The bullion yield of the Eureka Consolidated fell from 22,355 tons, valued at $1,010,211, in 1882, to 9,512 tons, worth $205,564, in 1883.

In the K. K. mine a new ore body was discovered on a drift running east 360 feet from the 200-foot level of the old Marcilena shaft. The ore was first found in the bottom of an intermediate drift 30 feet below the 200-foot level. The ore went down perpendicularly 12 feet and then branched east and west. Prospecting revealed a 12-foot vein of rich ore for 30 feet. It is supposed that the vein will widen towards the 300-foot level, making it a most important discovery. The ground on either side of the ore is good lime rock.

The Ruby Hill Tunnel and Mining Company was organized September 1, 1882. Work was immediately commenced, and $5,000 expended in running in a large surface tunnel for 400 feet.

The Prospect Mountain Tunnel Company was organized seven years ago and owns a large amount of mining ground upon the line of the tunnel, which is now in 2,350 feet. The eastern end is 1,080 feet perpendicularly below the surface, and is 80 feet north of the Silver Connor Hoisting Works. It passes under the Howard mine 1,000 feet from its mouth at a depth of 500 feet; under the Manhattan 1,500 feet from the mouth at a depth of 700 feet; under the Avon 1,700 feet from its mouth at a depth of 800 feet; under the Colorado 1,900 feet from its mouth at a depth of 900 feet. On the north of the tunnel the Gauger mine can be worked from it at a depth of 800 feet. On the east and south the Williams mine can be worked at a depth of 1,100 feet, and the Kit Carson and Matamoras mines at a depth of 800 feet. At a depth of 1,800 feet the Banner and many smaller mines can be worked. The end of the tunnel is now in a very dark, shaly limestone that has been much crushed at some time and afterwards cemented together by spa.

Eureka Tunnel and Mining Company.—By exploring at a depth of 150 feet below the tunnel level it has been proved that the ore body first found in the south drift of the main tunnel, that in the Addison chamber, and that in the old north workings 850 feet from the tunnel opening, is continuous. A hard vein of chloride ore is found above the tunnel level, and good ore is found 210 feet below the tunnel level on drifts from the main shaft. Unfortunate litigation between the president and the stockholders of the company has affected the prosperity of the mine for the past few months.

The financial showing for the six months from March 1 to September 1, 1883, was as follows:

EXPENDITURES.

| | |
|---|---|
| Hauling ore, machinery, and lumber | $3,653 77 |
| Powder, fuse, candles, and general supplies | 3,118 59 |
| Cordwood | 1,466 50 |
| Lumber | 1,418 50 |
| Water | 960 24 |
| Tributers | 557 87 |
| Foundry | 125 05 |
| Shaft and drift contracts | 2,056 75 |
| Assaying and materials for assay office | 217 66 |
| Stabling, shoeing, &c | 220 75 |
| Telephone rent | 72 00 |
| Bullion, State and county taxes | 269 20 |
| Recording, surveying, advertising, stationery, &c | 327 39 |
| Office rent | 120 00 |
| Boiler tubes, exhaust pipes, lumber, mining cars, pump, and supplies | 1,639 22 |
| Interest on notes | 1,310 81 |
| Legal expenses | 903 75 |
| Salaries | 3,150 00 |
| Pay-rolls—miners' wages | 31,673 69 |
| Total | 53,367 64 |

RECEIPTS.

| | |
|---|---|
| Net product of ores smelted at furnaces—1,425½ tons | $52,113 99 |
| Received from El Dorado Con mine for hoisting and supplies | 662 60 |
| Received from tributers for sundry supplies | 130 54 |
| Balance excess expenditures | 460 51 |
| Total | 53,367 64 |

The Alexandria mine is some 600 feet south of the Eureka Tunnel and about 600 feet from its adit near the summit of the mountain. The company owns 1,500 feet along the course of the limestone ledge lying between two beds of shale, the ledge covering 500 of the 600 feet of width of the claim. The first work on the mine was an incline 400 feet deep, from which levels were run along the ledge every 60 feet. A great deal of good ore was taken out and much remained in sight on the cross-cuts when the shaft was closed to await connection with the new shaft. A new double compartment shaft, 320 feet deep, was sunk 300 feet southeast from the old works. A 30-horse power engine hoists the cages and cars at the rate of 400 feet a minute. The 300-foot level was run across the shale and foot wall 100 feet when it entered the ledge. A stream of water sufficient for hoisting purposes was encountered and the cross cut extended 500 feet, with drifts north and south. On the 200-foot level a cross-cut runs 130 feet southwest, to explore the bottom of a cave 50 feet in diameter and about 35 high. This cave was struck from a cross-cut on the 100-foot level. The bottom of it is in iron and ore, and a winze was sunk 50 feet through paying ore. On the south end of the property the old Sterling Tunnel has been abandoned to tributers, who have paid the company $1,000 in the last five months. It is intended to run a drift from the new shaft to the ground below this old level. About twenty miners have been employed during the year.

The Magnet mine is on Prospect Mountain, north of the Eureka Tunnel, and the ore of the tunnel has been traced to the Magnet ground. Developments made at and near the surface of the mine have exposed good ore in different places, which is chiefly in seams of high-grade carbonates.

In the Albion mine the tributers are working on the back of the "Albion Cave," in a body of low-grade ore. The size of this ore body is governed by the foot and hanging walls, which vary in width from 40 to 60 feet. The ore is richer as it ascends, the richest being found on the hanging wall, which goes off in a northwesterly direction in virgin ground. A drift was started from the foot wall at the bottom of the cave to strike small chimneys of ore branching off from the main body. It is a fair prospect, and nearly on the same level where several of the fifteen ore chambers of the Richmond were found. At the east raise good work has been done in drifts, sinking, &c. A drift was carried in at the bottom of the cave a considerable distance on the foot wall, and a winze sunk 54 feet in a northwesterly direction, encountering ore from the start. The ledge varies from 2 to 10 feet in width. At a depth of 40 feet it branched farther northwest, and drifts were run from the winze. Running 12 feet in this direction the ore dipped downward, and a winze was sunk, finding an ore body 8 feet wide of good carbonate, mixed with galena.

In the "east raise cave" a good breast of ore is in sight going off in whole ground. In the June chamber tributers are at work, and much good ore is in sight. It cannot, however, be expected that they will strike as large bodies as have been found, as the Ruby Hill mineral belt, which is governed by the quartzite and shale, and which in the Eureka Consolidated and Richmond mines were 800 feet apart, come closer together at the Albion. There is room, however, between the two formations there for a considerable body of ore.

The Katie Ryland mine, formerly known as the Paul Jones mine, encountered a fine body of chloride of silver in quartz formation at a depth of 30 feet.

Rich ore was also found in the Water Jacket, Martin White, Harris, Reflex, Albion, Bay State, Rescue, Quinn, Silver Stone, Silverado, Bald Eagle, and Golden Rule mines.

The Silver Connor mine developed the largest body of ore ever found on Prospect Mountain. It was found on the 250-foot level and was raised to the 200-foot level. The main body was stoped out 20 feet in width and 20 feet in height. It was also cut through 10 feet on one side and 7 feet on the other, and the boundaries have not yet been reached. The ore ranges from $60 to $167 per ton.

A third interest in the Bangor and Young Ophir mines was sold to an English capitalist for $6,000 in cash, and important work has been begun. The mine has been opened to a depth of 120 feet and 750 feet of tunnels and drifts have been run. The quartz croppings stand 12 feet above the surface, and the ledge, 13 feet in width, continues all the way down. At the 100-foot level it changes from low-grade quartz to yellow carbonates between quartzite and blue lime. A tunnel is to be run 500 feet to tap the ledge 260 or 300 feet below the surface.

On the Sunset mine a rich seam of ore was found.

In the Pentier mine a ledge of high-grade ore was struck on the bottom of the first level, and an incline sunk 40 feet. A drift was run on the ore for 30 feet, and both incline and drift are in ore. A patent Baker iron whim was put in, the incline shaft was sunk 130 feet, and from the 80-foot level a drift was run 100 feet to tap the center shaft 160 feet from the surface. At the bottom of this shaft the ore averages from $100 to $160 per ton.

In the Dead Broke mine a large quantity of high-grade galena has been found.

On the Contact mine a surface tunnel has been run in broken limestone, seamed with very rich ore.

The Ruby and Dunderberg Mining Company is an English corporation owning the Home Ticket, Dunderberg, Lord Byron, and El Dorado mines. At the Home Ticket a poorer quality of ore has lately appeared, but during the year ending September 30, 1883, 3,220 tons gross was extracted.

The Dunderberg mine is being worked by tributers, and the profit from them during the year amounted to $8,000. In the Lord Byron a tunnel is being run which lacks 90 feet of making connection with the other workings. The El Dorado is leased to parties who hope soon to give good reports of it.

In the Clipper mine ore carrying from 20 to 50 per cent. of lead has been found.

The Bertrand mine and mill have not been working continuously during the year on account of the impossibility of the mine supplying the ore which the mill could work. In March the mill was stopped for want of wood and salt, as the condition of the roads made it very expensive to get supplies to the mine at that time.

The Colorado mine, after remaining idle for a long time, is now being worked, a 4-foot vein of ore and ledge matter being found. The south end of the mine is leased to McNaughton & Laird, and 30 tons of ore sent to the Eureka Consolidated furnaces gave $102 per ton. More ore of the same quality is in sight.

In the Connelly mine a drift of 50 feet has been run with a good showing for ore.

The Grant mine is being worked in part for flux quartz ore, the ore being unusually rich.

At the Hamburg mine the tributers are working successfully.

Good ore has also been taken from the Altoona and Uncle Sam Consolidated mines, the latter showing red lime and iron in the ore.

In the Dead Broke and Excelsior mines very rich ore has been found.

The following is an official statement compiled by the State assessor of the product of Eureka County during 1883:

*Statement showing the product and cost of operating the mines during the calendar year* 1883.

| Names of mines. | Ore extracted. | Gross yield. | Total cost. |
|---|---|---|---|
| | *Tons.* | | |
| Albina | 3,710 | $125,258 00 | $145,246 39 |
| Alexandria | 113 | 5,896 50 | 12,411 73 |
| Antelope | 2 | 141 27 | 188 00 |
| Altoona | 8 | 2,521 65 | 2,649 37 |
| Banner | 88 | 4,310 29 | 4,763 23 |
| Bertrand | 17,449 | 214,928 70 | 206,660 19 |
| Bowman | 72 | 3,262 47 | 3,747 55 |
| Butler | 7 | 217 91 | 222 80 |
| Bald Eagle | 73 | 4,985 23 | 5,691 61 |
| Brown | 7 | 191 49 | 202 47 |
| Billi Anzelli | 2 | 70 36 | 79 89 |
| Berryman | 1 | 69 20 | 76 27 |
| Berin | 1 | 29 07 | 30 90 |
| Christie | 3,186 | 33,793 68 | 27,002 04 |
| Connell | 1 | 50 31 | 58 35 |
| Connelly | 3 | 80 77 | 149 40 |
| Cameron | 1 | 95 34 | 120 37 |
| Cardinal | 4 | 403 37 | 448 18 |
| Casey | 1 | 18 90 | 28 75 |
| Cortez | 2 | 149 09 | 154 09 |
| Crossan | 6 | 150 01 | 178 30 |
| Charles Heyer | 61 | 1,386 94 | 1,444 86 |
| Dead Broke | 37 | 2,065 22 | 2,453 73 |
| Dugout | 111 | 8,881 24 | 7,614 65 |

*Statement showing the product and cost of operating the mines, &c.*—Continued.

| Names of mines. | Ore extracted. | Gross yield. | Total cost. |
|---|---|---|---|
| | *Tons.* | | |
| Delaware | 15 | $422 40 | $458 22 |
| Eldorado No. 2 | 29 | 1, 467 17 | 1, 638 43 |
| Excelsior | 10 | 166 10 | 228 86 |
| Enterprise, Prospect Mountain | 6 | 184 88 | 191 44 |
| Enterprise | 584 | 8, 375 02 | 9, 341 77 |
| Este | 2 | 229 78 | 272 87 |
| Eureka Consolidated | 9, 512 | 205, 564 45 | 305, 523 32 |
| Eureka Tunnel and Mine | 1, 529 | 74, 055 48 | 62, 541 36 |
| Eastern | 1 | 51 32 | 54 00 |
| Eureka Star | 4 | 122 87 | 137 78 |
| Franky Scott | 1 | 24 40 | 30 20 |
| Five-Twenty | 2 | 148 77 | 180 00 |
| Fandi | 25 | 1, 051 18 | 1, 477 00 |
| Fourth of July | 6 | 332 29 | 398 30 |
| Fletcher | 3 | 171 35 | 251 20 |
| Garrison | 860 | 55, 398 70 | 65, 360 00 |
| Grant | 46 | 2, 352 62 | 2, 505 32 |
| Gilmore | 1 | 40 28 | 42 50 |
| Hamburg | 471 | 18, 245 45 | 18, 849 92 |
| Herculean | 216 | 3, 552 27 | 3, 879 40 |
| Horace Toney | 5 | 115 65 | 181 14 |
| Hartnett | 3 | 127 34 | 138 08 |
| Idaho | 157 | 5, 784 14 | 5, 115 22 |
| Irish Ambassador | 30 | 4, 923 73 | 5, 107 43 |
| Industry | 5 | 244 55 | 280 80 |
| Ione | 1 | 44 18 | 48 42 |
| Jackson | 1, 399 | 48, 861 29 | 38, 472 47 |
| Kentuck | 12 | 1, 087 55 | 1, 267 17 |
| K. K. Furnace | 60 | 1, 043 77 | 1, 152 32 |
| Lawson | 1 | 11 08 | 16 62 |
| Little Mac | 1 | 25 37 | 31 66 |
| Macon City | 9 | 592 42 | 770 38 |
| May Day | 1 | 108 41 | 119 27 |
| Members | 273 | 3, 608 92 | 3, 752 56 |
| Matamores | 17 | 405 59 | 863 28 |
| McCuen | 23 | 497 15 | 573 90 |
| Mountain Boy | 4 | 551 20 | 575 33 |
| Mountaineer | 3 | 111 76 | 141 00 |
| Magnet | 4 | 124 68 | 154 56 |
| McBride | 16 | 439 33 | 510 36 |
| McDonald | 5 | 86 27 | 110 75 |
| Mineral Hill | 1 | 170 64 | 218 25 |
| Medlin | 1 | 21 69 | 24 20 |
| McManni | 1 | 31 90 | 36 60 |
| Margueritte | 9 | 618 42 | 671 40 |
| Onondago | 356 | 15, 900 38 | 18, 598 56 |
| Ozark | 4 | 70 54 | 77 71 |
| Orange | 2 | 28 62 | 45 05 |
| Oneida and Belmont | 28 | 637 95 | 722 75 |
| Paul Pry | 2 | 3, 261 79 | 3, 581 24 |
| Piute | 1 | 64 28 | 69 38 |
| Phenix | 201 | 6, 359 29 | 6, 744 07 |
| Prospect Mountain Tunnel | 5 | 274 19 | 283 71 |
| Pentier | 3 | 109 64 | 113 00 |
| Purcell | 1 | 40 02 | 46 39 |
| Republic | 42 | 765 24 | 1, 099 05 |
| Ross | 6 | 171 92 | 181 00 |
| Ruby and Dunderberg | 3, 667 | 92, 860 14 | 98, 804 57 |
| Richmond of Nevada | 10, 488 | 286, 273 11 | 256, 545 58 |
| Richmond Consolidated | 7, 783 | 154, 477 00 | 119, 366 87 |
| Rose | 1 | 57 13 | 67 36 |
| Silver Lick | 100 | 6, 772 22 | 6, 207 39 |
| San José | 9 | 405 74 | 462 53 |
| Silver Reef | 5 | 1, 357 49 | 788 54 |
| Silver Conner | 242 | 8, 799 83 | 6, 518 07 |
| Snow Cloud | 1 | 21 71 | 28 88 |
| Silver Stone | 4 | 117 70 | 166 07 |
| Silver West | 4 | 142 43 | 157 30 |
| Sunset | 4 | 145 47 | 155 57 |
| Vegas | 6 | 305 07 | 343 28 |
| Williams | 71 | 4, 772 76 | 5, 135 00 |
| Woodchopper | 9 | 1, 371 34 | 1, 024 44 |
| Wren | 1 | 34 36 | 36 47 |
| Austin | 8 | 1, 549 28 | 751 32 |
| Alturas | 1 | 32 38 | 33 11 |
| Ryland | 1 | 58 37 | 63 74 |
| Evans | 1 | 40 84 | 43 90 |
| Total | 63, 307 | 1, 436, 728 75 | 1, 533, 580 19 |

*Statement showing the product and cost of operating the mines, &c.*—Continued.

TAILINGS.

| Names of mines. | Ore extracted. | Gross yield. | Total cost. |
|---|---|---|---|
| | *Tons.* | | |
| Richmond of Nevada | 5, 240 | $128, 865 35 | $96, 389 43 |
| Ruby and Dunderberg | 1, 132 | 36, 564 67 | 28, 755 30 |
| Silver Connor | 103 | 3, 335 31 | 3, 451 44 |
| Shea | 11 | 261 81 | 296 00 |
| Wide West | 1 | 92 94 | 114 40 |
| Williams | 81 | 3, 574 06 | 4, 415 87 |
| Williamsburg | 56 | 1, 314 68 | 1, 641 84 |
| Silver Lick | 28 | 1, 658 58 | 1, 945 82 |
| Silver Reef | 8 | 1, 653 32 | 1, 854 42 |
| Stowell | 1 | 39 17 | 44 71 |
| Torginini | 1 | 120 19 | 128 20 |
| Thompson | 1 | 29 34 | 40 75 |
| Woodchopper | 5 | 1, 056 22 | 1, 370 15 |
| Total | 6, 668 | 178, 565 64 | 140, 448 33 |

During 1883 the amount carried by Wells, Fargo & Co. and deposited at the Carson mint from this county was $1,237,340 in silver, and the assessor's report shows the gross yield to have been $1,436,728.25; the difference, $199,388.25, was most likely base bullion, which the express company does not handle.

I have estimated the production of the county to have been: Gold, $600,000; silver, $850,000; total, $1,450,000.

## HUMBOLDT COUNTY.

The mining interests of this county have been active during the year and several new districts were opened up. Its products, however, did not vary materially from the preceding year. The principal producers were as heretofore, the Paradise mines.

The following interesting description of the leading mines of the Paradise Valley mining district is furnished by Mr. J. N. McCurdy, of Spring City, Nev.:

"The mining interests of the Paradise mining district have, as all other mining sections in the State of Nevada, been in a depressed condition, arising from several causes, among others the high freight tariffs and the discount on silver bullion, which caused many mines to lie idle that otherwise would have been operated with great advantage to the community. The Paradise mines were first located and work commenced in 1868, the Bullion of Paradise Mining Company and the Paradise Valley Mining Company being the principal companies that have to any extent operated their property and built mills to work their ore. The Bullion has been running a ten-stamp mill which lately burned down, and produced about $400,000 in silver and gold, the metal being about 10 per cent. gold.

"The Bullion mine was first worked by an open cut from the surface, the depth from 40 to 50 feet, and about 300 feet in length. Some very rich ore was found, and slate carrying native silver and forming beautiful specimens frequently appeared in the vein and on the walls. At the depth named the vein became broken, and a tunnel was run from the side of the mountain that tapped the vein only about 100 feet from the surface, being entirely too shallow reasonably to expect to find solid ground. A drift following the vein to the north line or boundary of the claim, about 500 feet, showed spots of good ore, and near the line a chimney of ore, which was found to extend up 75 feet above the level of high-grade ore some 30 feet in length, with an average of 4 to 5 feet in width. Two winzes have been sunk 75 feet below this level about 125 feet apart, and a drift connecting them shows a good prospect for an ore body. The north winze was sunk through a 4-foot vein of very good ore, showing much ruby silver, horn silver, and brittle silver, and no doubt the body of ore north of the winze before mentioned was cut in sinking this winze. South of where the tunnel entered the vein a drift was run on the vein about 300 feet; some good ore was found, which extended to near the surface. One bunch of ore was exceedingly rich above the level, but no effort has been made to ascertain the extent below.

"The ores were worked by wet crushing and amalgamated in pans without grinding, using bluestone, salt, and sulphuric acid as chemicals. The ores contain considerable iron and sulphur, and cannot really be designated or classed as free-milling ores.

"The ten-stamp mill of the Bullion was destroyed by fire November 28, 1883. It is supposed that it caught fire from sparks from the retort, as bullion was being retorted at the time the fire was discovered. Until just before the fire the mill had been insured for $20,000; but only half of that amount was being maintained at the time it was consumed. The Paradise Valley Company was negotiating for a long lease of the mill at the time.

"The Paradise Valley Mining Company was located in 1878 by citizens of Paradise Valley, and but little work of a scientific character was done to develop the property. An old miner having obtained a lease, commenced chloriding and shipping to Salt Lake some small quantities of ore for reduction. In a short time after commencing operations he hit upon a veritable bonanza. The crude manner in which it was worked and the large returns obtained enticed capitalists of San Francisco, Cal., to purchase the property and form an incorporation under the laws of California. Active operations were commenced in January, 1879. New bodies of ore were opened; the ore sacked and transported by teams to Winnemucca, there transferred to rail and shipped to Rye Patch, where it was reduced. In the following summer a fine ten-stamp mill, with White & Howell improved furnace, was erected on Martin Creek, between 6 and 7 miles from the mine. A stone dam was erected some 30 feet high, 4 feet wide, and 70 feet long, and a ditch 1¼ miles long was connected with the mill, the mill supplied with steam and water power, the whole costing $75,000. There are three distinct parallel ledges located in Mount Rose, a high, rugged mountain. A deep cañon to the east gives superior advantages for prospecting the veins by tunneling. The vein matter or formation is about three-quarters of a mile wide, slate, shale, or dike, porphyry, and granite forming the country rock.

"The Paradise Valley Mining Company went to work energetically and drove four tunnels, the upper or No. 1 tunnel following the vein into the mountain about 300 feet, and being at the face about 100 feet below the surface. About 200 feet in the vein broke up and was lost 65 feet below No. 1. Another tunnel was started and followed the vein about 300 feet; the vein was large, strong, and well defined, but carried but little pay ore. Above No. 1 tunnel, and between No. 2 and No. 1, a large amount of ore was extracted of high grade. A quantity was extracted by the leasor and shipped to Salt Lake before the Paradise Company came into possession, and there is no record of the amount of metal thus obtained. No. 2 tunnel was extended over 400 feet, but nothing being discovered it was abandoned. The tunnel was driven too far west, as will appear. No. 3 tunnel was started farther down the mountain and 116 feet below No. 2 tunnel. In driving a few feet the vein was encountered, and a large and very rich chimney of ore found about 10 feet wide by 80 feet long and 60 feet deep. The tunnel was run in over 600 feet. For the first 120 feet, after passing through the body of ore mentioned, the vein narrowed to 2 to 3 feet, carrying ore of lower grade. The tunnel then missed the vein for a distance of about 150 feet, then encountered the vein where it showed 2 to 3 feet of very fair ore for a distance of about 100 feet, then left the vein for about 150 feet to the face, where work was discontinued. No. 4 tunnel was started about 126 feet below No. 3 tunnel, and driven 812 feet. The tunnel does not follow the vein, and but few cross-cuts were made, and scarcely no prospecting to prove the vein was done. Two winzes were sunk between the different tunnels, making in all about 2,200 feet of tunnels and 650 feet sinking of winzes in twenty-two months' operations.

"The company having worked out the largest part of the two principal bunches of ore discovered, between Nos. 1 and 2 tunnels, and at the mouth of No. 3 tunnel, by the 1st of November, 1881, they closed down the works. The following winter the floods broke the dam in Martin Creek, and washed away between 200 and 300 feet of flume, thus leaving the mill in a crippled condition. Work was resumed in the Paradise in the latter part of August, 1883, at several different points in the different tunnels, and in each place with more than encouraging results.

"Thinking that No. 1 tunnel was driven west of the vein, a cross-cut was started east, near the face of the tunnel. In driving a few feet a stringer of quartz was cut that showed good ore. Following this stringer north about 10 feet the chute or chimney was found, which widened very abruptly to 14 feet, all of which is good ore, and some very rich.

"A drift of 86 feet has been run in this ore-body, the vein varying in width from 14 feet to 4 feet, and at the face it has narrowed to about 2 feet. The ore is good, but in places mixed with slate. The slate, however, carries much native silver and some spots of ruby silver. The ore is free milling. This tunnel is about 100 feet below the surface.

"In tunnel No. 2 a cross-cut is being run to tap the ore-chute on that level. In No. 3 tunnel at two different points bodies of ore are being opened, with every assurance of large quantities of good ore.

"An upraise was driven from No. 4 tunnel, which is now in good free-milling ore, and the vein is about 8 feet wide. Work throughout the two mines is limited and necessarily slow, as the property is worked upon its merits and without expecting any assistance from the stockholders. On the 1st of September, 1883, after getting squarely started, the indebtedness was over $10,000. This was liquidated and a dividend of 10 per cent., amounting to $2,000, was paid in December. From January, 1879, to November, 1881, $366,734.87 was produced, and from August to December, 1883, the gross amount of silver produced was $72,732.77 and $9,259.85 in gold, making a total of $81,992.62 produced.

"There are several other locations in this district that no doubt could be made good paying properties if a little capital was judiciously invested; among them the Red Deer, Live Yankee, Mount Rose, Rattler, Julia, Mayflower, Rosebud, and many others."

The Paradise Valley Company, after repairing its mill at a cost of several thousand dollars, purchased and worked the Wild Goose mine, and kept seventeen men at work, twelve of them at mining. The ledge of the Wild Goose is 3 feet wide in the upper stopes, and the vein is 12 feet wide in the lower level, at 100 feet below the surface.

The Wild Goose mine was the first location made on the Bullion ledge. The claim was recorded in April, 1878. But little work was done. The Bullion ran their tunnel past the line into Wild Goose ground and finding a strong vein of good ore located it as a blind ledge. A lawsuit ensued in which the Wild Goose owners were awarded the vein and heavy damages. In settlement the Bullion of Paradise gave the Wild Goose a deed for one-half of the tunnel, and one-half of their wagon road from the mine to the valley, and also 2½ acres of surface ground for dumping purposes, &c.

The Wild Goose Company then extended the tunnel, following the vein 180 feet north of the line. For 100 feet north from the line, the vein has an average width of 6 feet or over of very good ore. In part of balance of the drift the vein is broken and mixed with slate, but the indications are very favorable for a large and extensive mine. A winze was sunk 38 feet on the south line, which shows good ore; at the south line the tunnel is 175 feet below the surface, and at the face of the tunnel it is 225 feet to the surface.

In January, 1883, an effort was made to induce the Paradise Valley Mining Company to start operations. But the directors decided it impracticable; they thought that if the Bullion of Paradise Mining Company and the Wild Goose could be consolidated with the Paradise Mining Company operations might be resumed. That scheme failed finally, but, through the untiring efforts and financial aid of the citizens of Paradise Valley, arrangements were made by which the Paradise Valley Mining Company purchased the Wild Goose mine, and in July, 1883, began active operations to put the property in working shape.

The dam, which was poorly constructed, was partially removed and rebuilt in a substantial manner with Portland cement. The mill was thoroughly overhauled and ten large sand-tanks put in, and the necessary changes made for wet crushing. It is so arranged that in one-half day's time it can be changed to dry crushing and chlorodizing. Blanket sluices were also erected to concentrate the tailings after amalgamating in the pans. The mill consists of ten stamps of about 900 pounds each, four pans of about 2 tons to each charge, two large settlers and clean-up pan, a 100 horse-power engine, and a 22 American turbine wheel with 46 feet head. The ores of the Wild Goose, which are not really free milling, contain iron, sulphur, and some little arsenic and antimony, also native silver, chloride, bromide, sulphide, stephanite, and ruby silver. The Paradise ores are not so refractory and carry more chloride and native silver. By mixing with the Wild Goose, a very satisfactory result is obtained without chlorodizing, thus obviating the expense of roasting.

In July, 1883, work was commenced on the Wild Goose mine; a drift was started from the old workings of the Bullion mine, 75 feet above the tunnel-level and about 100 feet below the surface. The vein at this point is very narrow, but in a short distance it widened to 4 feet, and in about 40 feet it gradually increased to 9 feet in width. This drift was continued 80 feet through a solid body of high-grade ore, when it became somewhat broken, and work was discontinued on the face for two or three weeks. A raise was put through from the tunnel to this drift and some ore underhand stoped. Two raises are now working, one near the south line, and one at the face of the drift. Both ores are going up and the prospect is very favorable.

On the Red Deer mine only annual assessment work has been done, although in the progress of such work some very rich ore has been found.

The Live Yankee has a great deal of ore in sight worth $50 and $60 per ton, but until there are more mills in the district it will not pay to ship it.

In the Ore Cash mine annual assessment work has carried a shaft 40 feet from the surface, where rich ore has been found that would justify its being worked.

The Rattler mine has produced ore yielding $540 to the ton, but as there is no custom mill in the district the mine cannot be worked.

The Thornton, the Patterson and Henderson, the Gulch, and the Morse mine repeat the same discoveries of good ore, but all are hindered in their development by the want of a proper mill and the adverse reports of some experts.

At Spring Valley, in this district, 10 miles south of Unionville, seventy-five or eighty Chinamen were profitably working the old Placer mines, from which white men are said to have washed $1,000,000 worth of gold dust before they disposed of them to the Chinese.

*Dun Glen district.*—In this district the Lang Syne mine has been paying well during the year. Eight miners take out 15 tons of ore daily, which are worked at the mill.

The Auburn Consolidated mine has the same ore carrying free gold as the Lang Syne, but has remained idle.

*Star district.*—The Grizzly mine in this district is opened by one tunnel, and the vein, about 20 inches wide, carries considerable ore that assays over $1,000 to the ton.

*Cedar district.*—This new district is in the Antelope Mountains, 18 miles from Humboldt House. Float gold was found years ago, but the indications were not followed up, and this year Jahiel Smith found some partly oxidized galena ore at the base of a bluff. Searching, he found a body of galena ore 20 feet wide and carrying from $100 to $200 in silver to the ton, and is convinced that it is one of the largest bodies of ore ever found in the State.

The Humboldt Queen mine, situated about 3 miles north of the old town of Limerick, promises excellent results. The ore is gold-bearing and free-milling. There are good mines in the vicinity of this one, but yet not developed. A large amount of ore was on the dump of the Humboldt Queen in August, the low-grade ore assaying at $100 per ton, and the high grade being worth $300 per ton, as proved by working tests.

*Central district.*—Only a limited amount of prospecting has been done in this new camp on the west side of the Humboldt River, 12 miles from Mill City. The prospectors found narrow, but rich and well-defined, veins, and from the proceeds of the ores worked in a hand-mill and amalgamated in an iron baking-oven, supplied themselves with means for continuing their work.

The Locomotive mine has an incline shaft 70 feet deep, from the bottom of which levels have been run either way along the vein which carries on an average a foot of ore assaying $200 per ton. A very complete five-stamp mill is being erected and will be started in the spring.

The Marietta mine has been prospected to a depth of 300 feet, finding ore on all the levels that averaged $200 or more to the ton.

The Dutchman has a small vein of very rich ore, selected pieces of which assay at $2,000 per ton.

The Mollie mine was discovered in August and is producing good ore. Like the other mines, it is awaiting the completion of the Locomotive mill and the new mill at Mill City before undertaking extensive operations.

*Willow Creek district.*—Willow Creek station, the center of this new district, is 55 miles north of Winnemucca on the Idaho stage road. There many large and well-defined ledges bearing silver and gold, and some rich ore has been taken from the few mines which are in active operation. None of them have been explored lower than 20 feet from the surface. Placer miners have washed much coarse gold from the 6 miles of cañon through which Willow Creek runs, but owing to the bed rock lying very deep, and the flat country offering obstacles to drainage, the diggings have been abandoned to Chinamen.

On the David Crockett mine a shaft has been sunk 20 feet, and the ledge, 6 feet wide, stripped in many places. The ore is free milling and carries gold and silver in about equal quantities.

The Ranger mine is on a silver-bearing ledge, the croppings of which are 60 feet in width, and the assays give $128 in silver, with some little gold.

The Southern Belle mine has an open cut 50 feet long and 10 deep along the ledge. The vein exposed is about 8 feet thick, and from wall to wall the entire ledge will pay about $40 per ton in silver and $12 in gold. The ledge contains red and yellow carbonates, assaying $200 in gold and silver with about 40 per cent. in lead.

The Left in Poverty mine has an open cut across the ledge and shows ores of the same character as those of the Southern Belle.

The Choate Brothers' mine is on the gold ledge, their ore assaying at $90 per ton in gold, with no silver.

The Golden Era mine is 900 feet further up the cañon, and since its location in September four men have been at work making tunnels and cross-cuts and opening-out places along the ledge. At the end of October the end of the tunnel was 17 feet below the surface, the entire width of the tunnel being in ore that assays at $102 in gold per ton, with $3 or $4 in silver. It is a free-milling ore, and easily saved.

The Penobscot Boy mine is on the same ledge or mountain of auriferous quartz as the Golden Era, and several cuts across the ledge show it to be there 65 feet wide.

At Skull Creek, 6 or 8 miles from Willow Creek Station, rich placer mines were found in the fall and much excitement was occasioned thereby.

*Cove Meadows district.*—Extensive copper mines have recently been located in Cove Meadows. On Patterson, Clark, and Haynes mines there were ten miners at work on the vein, which is from 12 to 15 feet wide. It is proposed to erect smelting works as soon as the accumulation of ore will warrant it.

The county assessor reports the following as the product of the mines of this county during 1883:

| Company. | Number of tons. | Gross yield. | Total cost of production. | Net yield on which taxes are levied. | Tax. |
|---|---|---|---|---|---|
| Ross Mill and Mining Company | 1,522 | $3,241 97 | $12,967 90 | $1,055 40 | $27 4 |
| Auburn Consolidated Gold Mining Company | 1,200 | 8,647 69 | 6,829 30 | 1,818 39 | 47 2 |
| Silver Wave Mill and Mining Company | 74* | 1,162 98 | 1,112 25 | 232 59 | 6 0 |
| Iowa Consolidated Mining Company | 119 | 1,668 21 | 1,963 50 | 333 65 | 8 6 |
| Paradise Valley Mining Company | 1,992 | 70,407 68 | 43,826 90 | 27,930 57 | 746 1 |
| Bullion of Paradise Mining Company | 1,336 | 11,614 92 | 22,044 00 | 1,161 48 | 30 2 |
| Vande Water Company | 1,065 | 7,454 52 | 7,029 32 | 745 45 | 19 3 |
| Total | 7,308* | 104,197 97 | 95,773 17 | 33,277 53 | 885 1 |

*And 300 pounds.

Tailings: Bullion of Paradise Mining Company, 258 tons; gross yield, $1,290.

During 1883 the amount carried by Wells, Fargo & Co. out of this county, and the deposits at the Carson mint independent of that carried by that company, amounted to $94,264.

I have estimated the production of this county for 1883 to have been as follows: Gold, $30,000; silver, $80,000; total, $110,000.

## LANDER COUNTY.

In this county there was an increase of more than $300,000 over the bullion product of the preceding year.

*Lewis district.*—Business and mining have been very dull in this district during the year, and many mines are idle. The Eagle tunnel has been run in over 1,300 feet, and the contractors have made good headway. Some of the upper levels of the mine were worked under leases, and sufficient first-class ore was taken out to pay the tributers good wages.

*Reese River district.*—The Manhattan has been the only mill operating in this district in 1883, and its product, as reported by Mr. M. J. Farrel, was $1,182,085.58 in silver from 6,084¼ tons of ore. The ore-belt of the region is as wide as the Comstock, but the veins are narrow, being from 2 inches to 2 or 3 feet wide, with an average between 3 and 6 inches. The veins are of ruby silver and very rich. The veins lie nearly flat, and so far mining has not been conducted at a point lower than 1,000 feet from the surface, at which point some of the richest ruby and stephanite ores are found; most of the miners work on leases or contracts. At the Manhattan mill all the ores from the mines in the vicinity of Austin are reduced by the dry-crushing Studefeldt process, and much is brought there from a distance of 75 miles. The mill has twenty stamps of 1,000 pounds each, striking 100 blows a minute, and arranged in four batteries of five stamps each. The dry crushing reduces the rocks to the finest powder, and the pulp or dust is frequently sampled as it goes through the screens to determine its assay value. From these batteries the pulp is taken to a small two-stamp battery and mixed with pulverized salt. Thence it is carried to a series of screens, placed on top of the chimney-like furnace 48 feet high. Dropping evenly down through the flames, rising from two charcoal fires, it changes from a sulphuret to a chloride. The dust that is swept up by the screens, instead of falling to the bottom of the furnace, is caught in dust chambers in the long and tortuous flue, which has a total length of 500 feet from the furnace to the top of the outer brick chimney. The dust drawn from these chambers furnishes the finest of the bullion. The chlorinated and chloridized pulp is drawn from the furnace, and when slightly cooled taken to the pan room, where there are eight plain ivory and wood pans 5 feet in diameter and 2½ feet deep, making seventy revolutions a minute. The settlers are 6 feet in diameter with wooden mullers, and make twelve revolutions a minute. Each pan works a ton in each eight hours. From 600 to 1,000 pounds of quicksilver are used for a charge. Salt cyanide of potassium, scraps and borings of ivory, and other chemical agents are required in the pans. The quicksilver is forced out of the amalgam by hydraulic pressure and with three retorts and two melting furnaces, every day or two ten silver bricks, worth $1,000 each, are turned out. The engine for this mill is a Putnam valve horizontal engine, with 18-inch cylinder and 42-inch stroke, of 140 horse-power. The fly-wheel, 18 feet in diameter, weighs 14,000 pounds. This engine, with a bed 18 feet long, was made at the Union Iron Works, San Francisco, and was freighted to Austin before the railroad was built. There are three pairs of tubular boilers in the boiler room, one set being kept in reserve, and, with nine 6-inch pipes on each side of the fire-boxes or furnaces, there is no delay in getting up all of the steam required. By this dry-crushing process the mine becomes loaded with rich chloride dust, and the building is saturated with chloride fumes. At long intervals the works are stopped, the furnace allowed to cool, and the mill-house thoroughly swept and cleaned, and from this dust a large yield is obtained. The bullion yield for the half year ending June 30, 1883, is given by the Mining Record as follows:

| | |
|---|---|
| January | $114,338 68 |
| February | 95,243 41 |
| March | 101,368 72 |
| April | 194,403 35 |
| June | 118,168 53 |
| Total five producing months | 623,522 69 |
| Monthly average | 124,704 54 |

The Lander and Paxton ledges were in the latter part of the year producing very good ore, which supplied a considerable portion of the ore worked at the Manhattan mill. The principal incline at the Paxton is in 1,800 from the surface, the bottom being 1,000 feet below the surface level. The assessors' returns show their product to have been 985 tons, yielding $158,126.

The Breen mine is reported to have made an encouraging strike. Its gross yield, as given, amounted to $2,341 from 8 tons of ore.

From the *Yankee Blade district* wagon-loads of ore have been sent to Austin, where it is treated in the Manhattan mill.

*Bullion district.*—This is a new district in Lander County, near the Eureka County line, 6 miles from Cortez, and 83 miles from Austin. Bullion has a dozen houses and over fifty miners and prospectors waiting for active operations in the spring.

The following is the assessor's report, showing the produce and cost of operating the mines of Lander County during 1883:

| Names of mines. | Tons of ore extracted. | Gross yield. | Total cost. |
|---|---|---|---|
| Manhattan | 1,972 | $480,924 87 | $285,046 17 |
| Tribute | 102 | 35,231 71 | 27,135 71 |
| San Francisco tunnel | 19 | 3,053 95 | 2,624 00 |
| London | 26 | 3,032 92 | 2,040 00 |
| Great Eastern | 22 | 3,818 13 | 1,840 00 |
| Silver Side | 38 | 6,872 66 | 4,624 08 |
| Patriot | 139 | 40,070 15 | 29,452 89 |
| Plymouth | 22 | 8,490 16 | 6,565 37 |
| Breen | 8 | 2,341 94 | 1,287 87 |
| Merced | 16 | 5,862 18 | 3,800 12 |
| Silver Wedge | 309 | 84,164 49 | 63,032 47 |
| New Battle Mountain | 376 | 25,306 70 | 32,337 67 |
| Lady of the Lake | 87 | 8,386 79 | 8,062 81 |
| Lander and Paxton | 985 | 158,126 20 | 93,848 85 |
| | 4,121 | 865,682 85 | 561,698 01 |

I have estimated the production for 1883 to have been $133,000, of which all except $30,000 was silver.

## LINCOLN COUNTY.

*Pioche district.*—But little work has been done in Pioche during the year, and the outlook for the future is not encouraging. The ores are of a low grade character and small owners and tributers have been obliged to abandon their claims. Over one hundred stamps remain idle on account of the new tax on tailings. The Bullionville smelter finished concentrating their tailings from the Raymond and Ely Company and closed in October. It is not possible for it to resume while the present law remains in force. The base bullion shipped to Salt Lake City by the Bullionville Smelting Company produced from the tailings of the late Raymond and Ely Company were:

| | |
|---|---|
| Lead (tonnage 1,215$\frac{1628}{2000}$) | $57,749 15 |
| Silver | 157,790 80 |
| Gold | 16,982 35 |
| Total value | 232,522 30 |

The railroad belonging to the Raymond and Ely Company has been sold, and the rails removed to Iron City, Utah.

Mr. J. V. Keeley, of Pioche, gives the following statement of the ores shipped to various smelters in the vicinity of Salt Lake City, Utah, during the year 1883:

| Title of mine. | Ore tonnage. | Silver. | Gold. | Lead. | Total. |
|---|---|---|---|---|---|
| Burke | 1$\frac{1021}{2000}$ | $159 61 | $3 10 | $52 91 | $215 62 |
| Alps | 2$\frac{1744}{2000}$ | 343 10 | 8 16 | 45 08 | 396 34 |
| Lazard, Frerer, Raymond, and Ely | 7$\frac{1769}{2000}$ | 558 09 | 7 16 | 41 06 | 606 31 |
| Alpha | 11$\frac{1159}{2000}$ | 673 19 | 23 19 | 219 92 | 916 30 |
| Amador | 1$\frac{1025}{2000}$ | 517 00 | 19 33 | 16 91 | 553 24 |
| Sundry claims | 17$\frac{892}{2000}$ | 2,110 34 | 212 38 | 641 22 | 2,963 94 |
| Totals | 42$\frac{1610}{2000}$ | 4,361 33 | 273 32 | 1,017 10 | 5,651 75 |

The value and quantity of the concentrations shipped from tailings of Condar and Meadow Valley Company's operations to Salt Lake City were:

| | |
|---|---|
| Tonnage concentrations | 170$\frac{210}{2000}$ |
| Silver | $5,617 50 |
| Gold | 245 63 |
| Lead | 3,818 75 |
| Total | 9,681 88 |

Silver Dare Bullion: Meadow Valley Company's mill, $14,933.54; gold therein, $606.21. Floral Tailing mill, $11,921.14; gold therein, $208.56.

The method of smelting, although more expensive than the milling process, extracts a greater percentage of bullion, and is being generally adopted in this section, as it leaves no residue of tailings for taxation.

*Highland or Bristol district.*—The Day mine was discovered in 1876, and has been worked continuously since then. It is worked through a main shaft some 1,020 feet at an incline of 45 degrees, and a tunnel 900 feet in length and 300 feet below the surface. The best ore has been found on the lower levels of the mine, the fourth level producing good ore, and a natural cave with bottom of very rich ore was found on the fifth level.

The Mendha mine is owned by the Day Company, and the ore is a carbonate, with galena scattered through it, and averages $126 per ton in silver. A shaft has been sunk 160 feet on the ledge, and rich ore was found on the 84-foot level, the ore body being from 13 to 16 feet in width. The burning of the hoisting works interfered with the workings for a time. The ore is sent to Bullionville for reduction, but the company expects to start the furnace by the 1st of February, and with the ores of the Mendha and Jackrabbit mines expect to run the smelter continuously.

The old Hamburg mine has also been purchased by the Day Company, and they are now prospecting and running in new drifts.

The Kingfisher mine is producing remarkably fine ore, the formation being lime and spar, with rich stringers of high-grade ore running through it. A tunnel has been run in 620 feet, and a shaft sunk from it 75 feet on ledge matter.

The Bristol mill closed, and there is no prospect of its resuming work.

The Hillside claim has never repeated its wonderful product of $800,000 in 1878, and is now under a cloud.

The Tempest mine was relocated, and is expected will show something even better than the hundreds of tons of low-grade ore now in sight. It was formerly owned by Gilmore and Saulisbury, but now belongs to the Iron Silver Company.

The Terror mine has a 60-foot shaft, showing a 10-inch streak of ore to the bottom. The ore averages 81 ounces in silver and 45 per cent. of lead to the ton, and is valued by the smelting company for fluxing purposes.

The Anderson or Last Chance mine is a good property, but no systematic work has been done, and it has not been thoroughly prospected. Sample sacks of high-grade ore have been sold at the rate of 25 cents a pound in Pioche.

The Magnolia mine has an 80-foot shaft sunk through the ledge, showing 3 feet of galena ore.

Other mines of this district are the Wilcox, Eagle, Baxter, Arizona, and McNally.

*Stampede Gap district.*—In this district, some 3 miles west from the Mendha mine, there are large iron deposits, the ore being magnetic and hematite, the former carrying 80 per cent. of iron and the latter 45 per cent. From the silver claims adjoining the iron deposits several thousand dollars have been taken out by chloriders, and it is believed that the iron claims carrying silver will prove good properties when developed.

*Tempiute district.*—This district, situated near the western boundary of the county and distant 60 miles from Pioche, contains some valuable mines, but nothing but assessment work has been done on them. The most prominent mine, the Inca, has several times been bonded, but arrangements for its sale have always failed. It yields a free-milling ore, running up into the hundreds in the assays.

*Pennsylvania district.*—This district lies south of Pioche, and among the promising mines is the Klingensmith, on which a shaft has been sunk 186 feet on an incline of 45 degrees, showing ore on each of the drifts run from it and at the bottom of the shaft.

*El Dorado Cañon* is in the southern portion of the county, 200 miles from Pioche, on the bank of the Colorado River, which gives it communication by river steamer with the Atlantic and Pacific road. The mines have been known for fifteen years. The most promising claim is the Techatticup mine, owned by the Southwestern Silver Mining Company. Twenty-three men are at work, and a fifteen-stamp mill runs night and day. On the Cronin claim there is a ten-stamp mill crushing ore for the chloriders. From the Flagstaff mine the ore is shipped to San Francisco and disposed of at $400 per ton. Nickle & Co. shipped ore from their claim to San Francisco and sold it for $1,600 per ton.

*White River district.*—Ore was discovered by Messrs. Howe and Newton in May, 1883, near White River, and a new district formed. It is good smelting ore; averages $90 per ton in silver, and 44 per cent. in lead.

In the *Old Chief district* some attempts have been made to re-open mines, and ore gathered from the old mine dumps tested at the Dry Valley mill gave $135 in silver and $33 in gold per ton. The gold has to be extracted by chloridizing and roasting. The contemplated railroad through Lincoln County will pass through the Chief district, and probably revive its interests.

In *Hiko district* only assessment work has been done.

In *Patterson district* some fine discoveries were made, and prospectors have found ore ranging from $106 to $1,484 per ton.

*El Dorado Cañon.*—The Southwestern Mining Company have a fifteen-stamp dry crushing mill, with cylinder roaster attached. This mill was kept running last year for eight months on ore taken from the Savage and Techatticup mines, which belong to the company. These mines have produced some millions of dollars in bullion. The mill was started up in April of this year, and has been running regularly since. There are forty men employed on this property.

The five-stamp mill belonging to the Lincoln Silver Mining Company has been running on custom ore with good results. Miners are at work here on their own mines, and many others are chloriding. The intense heat of summer prevents the working of many of the mines in the cañon, but none of them are idle in winter.

I am indebted to Mr. John Baxter, of Pioche, for the following estimates of the bullion product of the leading mines of Lincoln County:

*Quarter ending March* 31, 1883.

| | |
|---|---|
| Bluitt mine | $298 90 |
| Bullionville Smelting Company | 60,234 32 |
| Alps mine | 130 00 |
| Garrison mine | 265 35 |
| Southwestern Mining Company | 9,941 42 |

*Quarter ending June* 30, 1883.

| | |
|---|---|
| Bullionville Smelting Company | 51,321 90 |
| Flora Tailing Company | 453 50 |
| Morning Star mine | 220 40 |
| Fairview mine | 191 25 |
| Bald Balk mine | 110 90 |
| Alps mine | 289 95 |
| Southwestern Mining Company | 13,874 53 |

*Quarter ending September* 30, 1883.

| | |
|---|---|
| Bullionville Smelting Company | 25,226 00 |
| L. J. mine | 3,500 00 |
| Mayflower mine | 295 20 |
| Meadow Valley mine | 1,955 00 |
| Washington Creole mine | 124 00 |
| John Purtcher mine | 378 00 |
| M. Ryan & Co., concentrations | 3,882 50 |
| Southwestern Mining Company | 15,247 55 |
| Southwestern Mining Company | 13,874 00 |

The following is the assessors' report showing the product and cost of operating the mines of Lincoln County during 1883:

ORES.

| Name of mine. | Number of tons extracted. | Gross yield. |
|---|---|---|
| Bullionville Smelting Company | 18,251 | $85,460 32 |
| L. J. mine | 100 | 3,500 00 |
| Mayflower | 7 | 294 00 |
| Meadow Valley | 52 | 1,955 00 |
| John Purtcher | 3 | 378 00 |
| Washington and Creole | 3 | 120 00 |
| Alps | 5 | 419 75 |
| Bald Balk | 1 | 110 90 |
| Fairview | 2 | 191 25 |
| Morning Star | 12 | 2,419 00 |
| Techatticup | 618 | 23,815 95 |
| Southwestern Mining Company | 765 | 24,770 00 |
| Los Angeles | 3 | 452 81 |
| J. Powers | 3 | 146 52 |
| Bluitt | 4 | 298 90 |
| Garrison | 2 | 265 25 |
| Total | 19,831 | 144,597 65 |

TAILINGS.

| | | |
|---|---|---|
| Bullionville Smelting Company | 3,119 | 73,370 23 |
| Nesbitt and Elam | 120 | 72 00 |
| Condon mill | 15 | 511 00 |
| Meadow Valley mill | 3,602 | 6,116 88 |
| Flora Tailings Company | 1,493 | 6,781 50 |
| Southwestern Tailings Works | 451 | 15,247 36 |
| Alps Syndicate | 1,409 | 704 50 |
| Murry Company | 3,000 | 3,000 00 |
| Lazard Freres | 4,000 | 4,000 00 |
| Total | 17,209 | 109,803 47 |

I have estimated the production for 1883 to have been, Gold, $30,000; Silver, $225,000; total, $255,000.

## LYON COUNTY.

*Palmyra and Indian Springs district.*—Mr. Walter Crowninshield, recorder, has furnished the following description of this district:

"It lies 10 miles east of Dayton, the county seat, and 17 miles east of the Comstock lode. Its principal mines are the Mount Como, Eureka, North Rapidan, West Rapidan, Buckeye, Hidden Treasure, May Day, Mayflower, Ely, Emma, Jacket, Monte Christo, Chieftain, and the Ely Como Mining and Tunneling Company. The Mount Como has been worked the past year by a San Francisco company. The first level is 200 feet, and shows good milling ore, some of which has been worked with satisfactory results at the Welter mill. At the 280-foot level the ore has increased in richness, and the vein becomes wider; the water has also increased to such an extent that heavier machinery has become necessary, and they are now putting it in. This mine lies on the west slope of the mineral-bearing range of the district, and, undoubtedly, has a bright future.

"The Como Eureka lies east of the summit of the mineral-bearing range, and has a three-compartment shaft 200 feet in depth. At that level some very rich ore was found, but so base that it could not be worked by common mill process. It is confidently expected that as it was free milling at the surface it will be found the same at a greater depth. The base ore on the 200-foot level shows bunches that are extremely rich in native silver. This mine has also encountered such a body of water that it has been found necessary to put in two new boilers and a larger pump, which will be accomplished by the 1st of March, and the mine started under a new management, when it is confidently predicted by those best qualified to judge that it will prove one of the best paying mines in Western Nevada.

"The North Rapidan lies some 200 yards west of the summit of the mineral-bearing belt, and has an incline shaft 230 feet in depth sunk on the vein the whole distance. At the surface the ledge was 5 feet in width, which increased gradually until at the bottom it has attained a width of 24 feet. At the bottom of the incline a drift has been run 100 feet on the ledge, all the way in ore, mostly of a low grade, though some would assay up in the hundreds. In doing the holding work for 1883 the drift was run south 32 feet, and opened a body of ore superior to any found heretofore. No water has as yet been encountered in this mine, and there is little doubt that with capital to sink from a depth of from 400 to 500 feet, a dividend-paying mine would be developed. It is a true fissure vein, running north and south with a dip to the east.

"The Ely Tunnel claim is situated near the eastern limit of the mineral belt, which it will cut at a depth of from 300 to 500 feet. It is now in 250 feet, and is being energetically pushed by H. W. Ely, the locator. If run as now proposed by the locator it will cut the Loraine, Elm City, Monte Christo, Chieftain, and May Day ledges, and be of great benefit as a drain to the above-mentioned claims.

"The Buckeye is right upon the ridge or backbone of the mineral belt of the district. A tunnel from the west side cuts the ledge at a depth of 150 feet. At that level the lode is 20 feet in width, and assays well.

"The Ohio is a north extension of the Buckeye, and is also patented. A shaft has been sunk 200 feet, from which assays as high as $3,000 have been obtained. The above-mentioned claims are the principal ones of the district so far as prospected, though perhaps, with capital to prospect them, there are many others that would prove as good or better.

"There are over one hundred locations in the district, most of which are on large veins that crop from the surface, and on many of them the holding work has been done for the year 1883, showing that the locators have full faith in the district.

"There are also placer mines in the district that, with sufficient water, would doubtless amply remunerate the proprietors. Some of them were worked with a partial supply from the Como Eureka mine with satisfactory results."

*Silver City district.*—I am indebted to Mr. H. W. Arnold, of Silver City, for the following interesting and valuable information in regard to the production of the mills in the district:

"Silver City district was located in 1859 by B. F. Brown and Benjamin Hover, who laid out the town site and commenced selling town lots during the Washoe excitement. The most noted claims of that day were the Pride of the West, Chenango, Daney, Twin, Pioneer Comstock, McNeil, Buckeye, Dayton, Kossuth, Rich, Lucy Ella, Emigrant, Genesee, Santiago, &c.

"The Genesee was sold for $160,000, and many other claims were sold at high figures.

"The Pride of the West sold at one time for $300 per foot. It must have yielded at least $500,000. But most of the excitement culminated in Gold Hill and Virginia, and most of the capital concentrated there. We had twenty odd quartz mills at one time and all running on pay ore. Now they are very few.

"The principal towns are Silver City, Dayton, Warbuska, and Sutro. We have now the Hope mill of eight stamps for working gold ore, the crushed rock being run over copper plates. It is run by water-power, with a 2-foot hurdy-gurdy wheel, 160 feet pressure, through a 1½-inch nozzle. The Excelsior (ten-stamp) mill is run by steam power and works gold and silver ores. The Atlanta Steam mill is used for working tailings.

"The Rocky Point mill (water) of twenty stamps, at Dayton, on the Carson River, was built this year by C. C. Stevenson, who has the lease of the upper levels of the Empire, Imperia, and Kentuck mines, and also the Lady Bryan.

"The Lyon mill, at the same place, is run by a turbine wheel, with ten stamps. It works tailings and base ores and makes bluestone.

"The Ophir or Woodworth mill (tailings) is located above Lyon and owned by Macky & Fair. Of the mines, there are the Cook & Gray, Midas, Flora Temple, and Little Giant, which have yielded this year about $10,000 ; the Silver City, about $3,000; the Schlomberg, about $25,000; the Vivian mine, very little; the William Penn, $1,000 ; the Cosmopolitan, $1,000; the Erie Consolidated, Hudson, and Plato, very little; the Alhambra, working five men, nothing; the Umatilla, about $5,000; the Daniel Webster, nothing; the Buckeye, about $3,000. The Regent for four years has employed ten men and produced about $20,000; the Kossuth, having hoisting works and 400-foot shaft, yielded nothing; the Dayton, with a 700-foot shaft and hoisting works, nothing; the Cherokee was idle; the Santiago yielded $3,000; the Big Gun, about $1,000; the Pioneer, about $4,000; the Mount Bullion, about $6,000; the North America, $5,000. The Atlantic, Grant, Industry, Del Rey, and Esperanza were all idle.

The milling product of the Silver City district for the year ending December 31, 1883, is estimated by Mr. Arnold as follows:

| | |
|---|---|
| Midas | $10, 000 |
| Silver City | 3, 000 |
| Schlomberg | 25, 000 |
| William Penn | 1, 000 |
| Cosmopolitan | 1, 000 |
| Umatilla | 5, 000 |
| Buckeye | 3, 000 |
| Regent | 20, 000 |
| Santiago | 3, 000 |
| Big Gun | 1, 000 |
| Pioneer | 4, 000 |
| Mt. Bullion | 5, 000 |
| North America | 5, 000 |
| Total | 86, 000 |

Rock Point mine.—The new Rock Point mill was erected by Mr. C. C. Stevenson for reducing ores of the Kentuck and other mines. Everything has been done to make it labor-saving and to perfect its processes, in order that the low-grade ore of the Comstock may be made to pay. It stands on the site of the old mill, and in convenience and appointments has never been excelled by any quartz mill building in Nevada. The four five-stamp batteries are or may be run independently of one another, and there are eight pans for grinding and amalgamating, four settlers, one clean-up pan, and one agitator. There is a machine-shop back of the batteries, and the Blake rock breaker is placed where the ore too large for the batteries falls after having passed over the grizzlies. The power is furnished by a 36-inch Leffel turbine wheel, under 20 feet of head or water pressure. The ore dump on the point of the hill is level with the roof of the mill, and a car track of T-rails conducts over a substantial trestle to the grizzlies. The ore small enough for the batteries falls through the grizzlies into bins, and the larger pieces pass on to the rock breaker. The ore falls into automatic ore feeders of Mr. Stevenson's patent, and is evenly supplied to the batteries. The steam for heating the pans is furnished by a tubular boiler in front of the retort, on the ground floor, both substantially walled with brick. The sulphurets, slums, and tailings are carefully saved. The water is taken from the Carson River, 200 yards below the stage road bridge. The dam is made of rock and timbers, and between the abutments there is an apron 200 feet long and 70 feet wide, made of 2-inch plank, securely spiked to the timbers below. The surplus water escapes over this apron, and the water for the mill passes through a substantial gate of framed timbers and plank to a ditch or canal, and thence by a flume 1,000 feet long is discharged upon the turbine wheel. The flume is 4 feet deep and 8 feet wide.

The following is the assessor's report showing the product and cost of operating the Lyon County mines during 1883:

ORES.

| Names of mines. | Tons of ore extracted. | Gross yield. | Total cost. |
|---|---|---|---|
| Lower Comstock Mining Company | 60 | $1,200 00 | $1,620 00 |
| C. C. Stevenson Mining Company | 302 | 6,057 23 | 17,434 74 |
| Total | 362 | 7,257 23 | 19,054 74 |

TAILINGS.

| | | | |
|---|---|---|---|
| Atlanta Mill Mining Company | 9,200 | 26,352 03 | 24,609 45 |
| Franklin Mill Mining Company | 2,880 | 8,688 00 | 8,010 00 |
| J. M. Douglass & Co.'s mine | 28,706 | 62,078 21 | 58,447 90 |
| Little Bonanza mill Company | 420 | 2,700 00 | 2,270 00 |
| Woodworth Mill Company | 17,260 | 65,273 09 | 58,701 55 |
| Total | 58,466 | 165,091 33 | 152,038 90 |

The amount carried out of Lyon County by Wells, Fargo & Co. and that deposited at the Carson mint through private sources amounted to $112,866, showing a difference in favor of the gross yield and working of tailings of $59,482.01 as shown by the assessor's report.

I have estimated the production at: Gold, $45,000; silver, $70,000; total, $115,000.

## NYE COUNTY.

The production of this county for the past year showed a decrease of over $50,000 from 1882. The Tybo Consolidated and Downieville report greatly reduced production, while Belmont, Jefferson, and Twin River have been more vigorously worked than heretofore, but have not succeeded in making up the year's deficiency.

*Ellsworth district.*—At Ellsworth, in the western part of Nye County, leaching works have been constantly in operation. In this district there are large quantities of low-grade ores thrown out upon the dumps in former years because they could not be profitably worked by the ordinary processes, but which it is believed will now pay to leach. Mr. H. Harris, who has charge of the leaching works, is pleased with the melting furnaces, and says of their operation: "After shutting down Saturday and Sunday, I started the works in full blast this morning. The flues were choked up to a fearful extent, and Holman has now put in a damper between the first and second dust-chambers, so to keep the flue-dust, or, at any rate, most of it, right there where we can have easy access to it. We melted bar No. 7 yesterday, melted and poured it in just four hours by the watch. I never saw better drawing melting furnaces than ours are now. The bar was the biggest we have shipped so far: 1,172 ounces, 956 fine; value in silver, $1,447.06; in gold, $36.39; total, $1,483.45. Our total bullion shipments to date (December, 1883) are $9,306.68."

*Tybo district.*—Hon. P. Downey furnishes the following interesting statement in respect to Tybo district:

"But little can be said of mining in this (Tybo) or contiguous districts, as there has been almost complete stagnation in this business during the past year.

"The only mine which has been operated in this district is the Two G. mine, owned by the Tybo Consolidated Mining Company, but worked by N. S. Trowbridge & Co. This mine has in the past nine years produced over $4,500,000, but for three years past has been under a cloud, owing to the inability of the owners to properly develop it and to the high cost of labor and supplies, which prevents the profitable working of low-grade ores. This mine and others in this and surrounding districts are capable of furnishing practically inexhaustible supplies of ores, carrying from $15 to $25 per ton in silver, but with present facilities for working ores, and cost of materials and labor, they cannot be worked to a profit. This section of Nevada is extensively mineralized, and numerous mines have been prospected to a considerable extent, which are destined with the advent of cheap freights, living, and labor to make it a live and prosperous country. Freights to this place are from 5½ to 10 cents per pound from either east or west; wages from $3.50 to $6 per day, and the country cannot *live* under such prices. Until we have cheaper freights, upon which all other prices depend, this section will not take the rank in the business of mining which its natural capabilities ought to give it."

During September the Two G. yielded $17,000, with $2,000 or $3,000 of amalgam remaining over. By close milling the company can utilize the great mass of ore in the mine, and the quantity that has been lying on the dump for these years of idleness.

*Mammoth mining district.*—Mr. Downey also writes concerning this district:

"The mining interests of this district have been much neglected in the past year.

"In 1882, the Downey mines were the principal producing mines. But through unwarranted heavy expenditures in erecting costly buildings and machinery, and through general bad management the owner of these mines got in debt and had to suspend operations early in June last. These mines produced no bullion in 1883.

"The Ellsworth mill ran on custom ore for the last quarter of the year. A large percentage of the ore worked came from the Ione district, 10 miles east of Ellsworth. The mill management are reticent as to their milling operations. I have been unable to get any satisfactory statement of the amount of bullion produced. I estimate the production of bullion from this mill as, silver, $12,000; gold, $1,000."

*Currant district.*—Some excitement was occasioned by the discovery of a ledge of ore on Currant Creek, in the same range of mountains as the Eberhardt mine. People deserted their ranches, but as yet only prospecting has been done. The ore has horn silver, but the formation is different from that of the Eberhardt, and is the same sandstone formation as at Silver Reef, Utah. In the Bottomfields and Buckeye claims the croppings for 3,000 feet assay from $14 to $22. The ledge was an inch wide when struck, but at a depth of 5 feet is 11 inches wide.

*Belmont district.*—Operations in the Belmont mine were pushed with energy, and considerable rich ore was discovered and extracted. Expenditure for the year 1883 is greatly exceeded by the value of the ore extracted in exploring the mine. Every dollar paid out is expended in explorations. Leaching tanks and amalgamating pans are to be done away with, and experiments have demonstrated that lixiviation is the cheapest and most effective mode of extracting silver from the ores. On the lower levels the ore is rich in chlorides carrying black sulphurets. Good ore assaying into the hundreds has been taken from the winze in the south ground. The chlorinations averaged 91 per cent. by the new Bruckner furnace. In the fall the works were overhauled, the engines and boilers refitted, and the battery supplied with new shoes, dies, and guides. The four Bruckner furnaces were relined and put in perfect order. The leaching works are in a building west of the mill, 50 by 50 feet in extent, and are among the best arranged works in the country. The ore goes into the self-feeders, and from the battery the pulp is elevated into hoppers, a furnace charge in each hopper. Each furnace is charged in three minutes, and under them are placed cars which are filled by opening the furnace doors. These cars are then discharged on to an inclined brick cooling-floor, from the lower end of which the pulp is discharged into the leaching tanks. The six tanks are each 7 by 14 by 2, and are supplied by pipes from reservoirs with water and hyposulphate. The tailings, with a small quantity of water, are discharged through V troughs. There are twelve tanks in the precipitating-room and a sulphide furnace, and the sulphides are roasted under the supervision of the leacher, thus avoiding loss or wastage. A steam-pump elevates the hyposulphate into the reservoirs above the leaching tanks. The mill and leaching works are so arranged that but few men are required to do the work.

In the Seventy-seven mine much rich ore and one very large pocket of ore assaying into the hundreds was found.

*Jefferson district.*—The mines of Jefferson Cañon are 75 miles south of Austin, and were first discovered in 1866, since which time they have yielded richly. The bullion contains some gold, but the claims remain as silver mines. The large and well-defined ledges can be traced for miles, two running parallel north and south. Rich chimneys of ore have been found, but for some years the mines have been in disrepute and little work has been done.

Both the Jefferson and the Prussian mills were idle during part of the year. The ores comprise horn silver, black antimonial, and ruby silver, sulphuret and chloride forms of silver, and more or less gold. The ledges vary from 3 to 30 feet in width, dip east, and have been worked to the depth of 700 feet. There is enough good ore in the upper levels to employ the miners busy for many years, and in the lower levels the strong flow of water requires expensive machinery.

In the Union mine a rich free-milling ore was found, of a strong reddish cast, containing a small proportion of gold and is rich in horn silver. An arastra will be built and the leaching process adopted. The ledge is 2½ feet thick and the ore averages $300 per ton.

Two Mexican miners leased 600 feet of the Jefferson carbonate mine, adjoining the old Jefferson mine. They sunk an incline 35 feet, at which point the ledge measures 3 feet in thickness. The ore is carbonate on the surface, but changes into sulphurets as it descends, and assays from $150 to $300 per ton.

On another claim, 50 feet west, an incline of 37 feet has been run on a large ledge of the same kind of ore.

*Reveille district.*—The Gila mill is working at tailings and several bars of bullion have been shipped. A number of men are at work in the district and the prospects are excellent.

*Washington district.*—In the Birdie mine, in Washington district, rich ore was found. There are several valuable mines near it, but little work has been done during the year.

The Centennial Gravel mine suffered from the heavy rain-storms of the fall months, which flooded the shaft faster than the machinery could control it. An addition of 70 feet was made to the tunnel, which it was expected would carry off the water. The shaft is now down 90 feet and will be sunk further.

The mines in the *Silver Point district* were steadily developed, and the ore was hauled to the Jefferson mill for reduction.

*Bell district.*—In the Bell district mining prospects have been good during the year. The building of the Utah Western Railroad will greatly forward its prosperity. Mr. George Earnst has been extracting ore from his mine, which is rich in silver and lead. The ledge as uncovered is a genuine bonanza, measuring 40 feet in width, and in some places it is 100 feet wide, with every indication of its continuing to a great depth.

*Northumberland district.*—In this district, and Park, Summit, and Broad Cañons, there are large quantities of low-grade silver ores, promising to pay handsomely if they could be cheaply reduced. As much as $10,000 in bullion was shipped in one month.

*Assessor's report for Nye County, showing the product of the mines during the calendar year* 1883.

| Names of mines. | Ore extracted. | Gross yield. |
|---|---|---|
| | *Tons.* | |
| Belmont | 1,542 | $42,254 38 |
| Downieville | 422 | 21,177 18 |
| La Salle | 1 | 162 81 |
| Queen Elizabeth | 4 | 1,114 41 |
| Twin River | 1,800 | 22,785 09 |
| Good Hope | 1 | 170 00 |
| Jefferson | 560 | 15,477 00 |
| Prussian | 390 | 5,207 00 |
| Silver Point | 187 | 8,510 00 |
| Blue Bell | 108 | 9,834 12 |
| F. E. Osgood | 3 | 359 99 |
| Reveille | 12 | 1,582 24 |
| Tybo Consolidated | 1,700 | 60,525 00 |
| N. F. Leon | 12 | 963 41 |
| Unknown mines | 538 | 11,100 00 |
| Total | 7,280 | 201,222 63 |

The amount carried by Wells, Fargo & Co. out of this county during the year and that deposited at the Carson mint from other sources amounted to $63,535.

I have placed the production of this county at $200,000, of which $20,000 was gold.

## ORMSBY COUNTY.

The amount shipped by Wells, Fargo & Co. from this county, together with that deposited at the mint and not handled by the express company, amounted to $8,583.

The assessor makes no report of production for the year.

I have estimated the production at $5,000 gold and $5,000 silver.

## STOREY COUNTY.

*Comstock and Gold Hill.*—The amount of new work done in the leading mines on the Comstock in 1883 was unusually small. Nearly all of the work done by some companies has been in cleaning out, retimbering and repairing old drifts, cross-cuts, and winzes, preparatory to running exploring drifts on the lower levels.

A good deal of work has been done on the old levels for the purpose of securing drainage and in order to obtain a better circulation of air. All of this dead work has been absolutely necessary to the keeping up of the mines, and will be found of great value in future exploring and prospecting operations.

In the Gold Hill section, owing to the lower levels of all the leading mines being flooded, the extraction of low-grade ore from the old upper levels is the only work that has been done.

Since the first deposit of ore was found on the Comstock lode, a quarter of a century ago, its mines have had a varied history. Ten years ago the great bonanza was found in the California and Consolidated Virginia at a depth of 1,200 feet, and for five years that vast supply of rich ore seemed inexhaustible. The California paid its last dividend in December, 1879, and the Consolidated Virginia in August, 1880. Since that date only one mine on the Comstock, the Kentuck, has paid a dividend. Last year forty-five mines levied ninety-eight assessments, which, if all collected, would have yielded $4,480,000. All the work for the past five years has been largely a milling proposition, and the balance-sheet between the mines and their owners for this period might be stated in this manner:

| | |
|---|---|
| Assessments in five years | $29,367,090 |
| Dividends in five years | 3,732,600 |
| Excess of assessments | 25,634,490 |

The stockholders are supposed to have paid in the $29,367,090 in assessments in addition to the value of the bullion produced. At a rough estimate the cost of working the mines has been $40,000,000, and at least $36,000,000 of this has been a dead loss to the stockholders.

The twenty-four mines levying assessments this year are:

| Mines. | Number of assessments. | Per share. | Amount. |
|---|---|---|---|
| Utah | 4 | $3 50 | $70,000 |
| Sierra Nevada | 3 | 3 00 | 300,000 |
| Union Consolidated | 2 | 1 50 | 150,000 |
| Mexican | 3 | 2 50 | 251,000 |
| Ophir | 3 | 2 50 | 251,000 |
| California | 2 | 40 | 216,000 |
| Consolidated Virginia | 1 | 20 | 108,000 |
| Best & Belcher | 2 | 1 00 | 100,800 |
| Gould & Curry | 2 | 1 00 | 100,800 |
| Savage | 2 | 1 00 | 112,000 |
| Hale & Norcross | 3 | 1 50 | 168,000 |
| Chollar | 2 | 1 50 | 168,000 |
| Potosi | 3 | 1 00 | 112,000 |
| Julia Consolidated | 1 | 10 | 11,000 |
| Bullion | 1 | 20 | 20,000 |
| Exchequer | 1 | 20 | 20,000 |
| Consolidated Imperial | 2 | 10 | 50,000 |
| Confidence | 1 | 25 | 6,240 |
| Belcher | 1 | 25 | 26,000 |
| Caledonia | 1 | 20 | 20,000 |
| Silver Hill | 2 | 10 | 10,800 |
| Justice | 2 | 20 | 21,000 |
| Alta | 3 | 75 | 81,000 |
| Benton | 2 | 20 | 21,600 |
| Total | 49 | .......... | 2,395,240 |

The Alpha, Crown Point, Kentuck, Overman, and Yellow Jacket are the only active mines that have not levied assessments this year. The amount paid in in assessments for this one year on the twenty-four mines above mentioned is nearly equal to the market value of the whole number of shares.

In the mines of the Bonanza Company one foot of timber has been put in for every dollar that was paid out; $120,000,000 was paid by the mines and 120,000,000 feet of timber at two cents a foot has been put in. A body of territory 1,300 feet long and from 10 to 200 feet wide was worked out between the 1,200 and 1,950 foot levels and heavily timbered. In many places these decaying timbers are on fire, and the smoke and gas from these smouldering tunnels is confined by air-tight bulkheads of solid timbers 60 feet thick. The ventilation in this group of mines is effected by three separate currents of air. One current, carrying 1,600 feet of air a minute, goes down the C. and C. shaft to the 2,900-foot level and up the Bonner shaft. Another, carrying 20,000 feet a minute, goes down the Ophir shaft to the 3,100-foot level and up the Consolidated Virginia shaft. The third current of air goes down the Union and up the old Sierra Nevada shaft, reaching the 2,900-foot level and carrying 12,000 feet of air a minute. At 1,000 feet lower these currents would have the velocity of a gale on the surface. At the bottom of the mines, becoming heated to a temperature of 100° and over, it increases its capacity for absorbing moisture and carries out in steam 16,000 gallons, equal to a stream of one miner's inch of water. The mines are no hotter at 3,100 feet than at 1,500 feet, except when a vein of hot water is tapped. It is supposed that the heat is due to the chemical action of the lime in the rock becoming dissolved by water. The water does not increase with the depth of the mine, and instead of finding new water at the bottom they are draining the water from the levels above. The ore on the 3,100-foot level is now handled as cheaply as that on the 1,500-foot level was ten years ago, owing to the improved methods and machinery.

Utah Silver Mining Company.—This company has its own hoisting works, with a shaft 2,500 feet deep. The water is pumped to the Sutro Tunnel level, but the pump runs only a portion of the time. When at work it raises 144,000 gallons in every twenty-four hours. The work in 1883 was principally on the upper levels. On the 1,350-foot level they ran a cross-cut out to the west wall, a distance of 207 feet. On the 1,750-foot level a drift was run north 85 feet, and one northeast 213 feet. The latter shows quartz yielding low assays. All the work done on the 2,500-foot level was to extend the main east drift a distance of 69 feet. The material on this level is vein porphyry, quartz, and clay. The quartz gives low assays in the precious metals. During the year a great deal of overhauling and repairing has been done, also dead work in making air and water connections. Five assessments of $1 per share were made during the year.

The secretary's report for the year is as follows:

| Items. | Dr. | Cr. |
|---|---|---|
| Assessment No. 40 | | $20,000 00 |
| Assessment No. 41 | | 20,000 00 |
| Assessment No. 42 | | 20,000 00 |
| Assessment No. 43 | | 20,000 00 |
| Assessment No. 44 | | 20,000 00 |
| Advertising | $971 10 | |
| Books and stationery | 144 70 | |
| Compressed air | 1,535 75 | |
| Expense at Virginia City | 254 41 | |
| General expense | 1,578 85 | |
| Hoisting | 575 40 | |
| Interest and discount | 564 20 | |
| Loss and gain | | 2,101 51 |
| Legal expense | 6,738 16 | |
| D. B. Lyman, superintendent | 98 66 | |
| Nevada Bank | 430 21 | |
| Real estate | 903 25 | |
| Supplies | 6,360 79 | |
| Salaries and wages | 50,615 75 | |
| Surveying | 10 00 | |
| Tax | 1,149 13 | |
| Transportation and hauling | 4,270 73 | |
| Team expense | 471 83 | |
| Water and ice | 4,269 31 | |
| Wood and timber | 20,955 91 | |
| Cash on hand | 193 37 | |
| | 102,101 51 | 102,101 51 |

The Ophir mine.—On the 2,900-foot level of this mine a drift was run south 420 feet to the California Company's line and north 255 feet to the south line of the Mexican mine. On the California line a joint west cross-cut was run 40 feet, from the face of which a diamond drill-hole was run a distance of 225 feet; also a joint California cross-cut was run east 23 feet. All of this work was in vein material—quartz, clay, and porphyry—of little value, though showing some metal.

The joint Mexican winze, which was down 162 feet below the 2,900-foot level in 1882, reached the 3,100-foot level in July, 1883, when it was equipped with a double reel, hoisting engine, and double cages, and a large station excavated. From this station a joint Mexican drift was run east 170 feet, and from the face a diamond drill-hole was run ahead some 150 feet, showing the presence of water, when work was discontinued. A drill-hole was run south from the station a distance of 250 feet, showing no water in that direction. At this point explorations ceased, to await the junction of the main north drift started from the station at the bottom of the joint winze by the Mexican Company to connect with a drift started south on the 3,100-foot level by the Union Consolidated Company. This connection has now been made.

The Ophir shaft and incline reach a depth of 2,500 feet. The water pumped to the level of the Sutro tunnel amounts to 350,000 gallons every twenty-four hours.

The financial statement for the year is as follows:

RECEIPTS.

| | |
|---|---|
| Balance last year's report | $3,336 37 |
| Salaries | 58,847 00 |
| Supplies and mining expenses | 34,015 53 |
| Office expenses | 75 05 |
| Drafts on president | 297,353 36 |
| Total | 393,627 81 |

DISBURSEMENTS.

| | |
|---|---|
| Salaries | $167,985 16 |
| Supplies, &c | 154,674 35 |
| Office expenses | 595 45 |
| Legal expenses | 416 67 |
| Water and ice | 7,820 05 |
| Taxes | 3,249 42 |
| Milling | 25,995 64 |
| Sutro tunnel royalty | 1,944 35 |
| Morgan mill expenses | 29,377 54 |
| Exchange | 751 50 |
| Gross expenses | 392,810 13 |
| Balance cash on hand | 817 68 |
| Total | 393,627 81 |
| Gross expenses | 392,810 13 |
| Received from other mines | 92,987 88 |
| Net expenses | 299,872 25 |

The secretary's report was as follows:

DISBURSEMENTS.

| | |
|---|---|
| Legal expenses | $416 67 |
| Assessment | 377 00 |
| Insurance | 1,800 00 |
| Supplies and mine expenses | 120,658 52 |
| Office expenses (Virginia) | 520 40 |
| Water and ice | 7,820 05 |
| Taxes | 3,639 72 |
| Freight on bullion | 121 70 |
| Reduction of ore | 25,995 64 |
| Sutro tunnel royalty | 1,944 35 |
| Discount on bullion | 2,475 87 |
| Interest and exchange | 926 05 |
| Wages and salaries | 109,138 16 |
| Office expenses (San Francisco) | 5,856 55 |
| Morgan mill property | 16,000 00 |
| Morgan mill supplies | 13,377 54 |
| Superintendent's balance account, 1883 | 817 68 |
| Bullion on hand (gold) | 13,855 78 |
| Bullion on hand (silver) | 7,554 09 |
| Total | 333.295 77 |

RECEIPTS.

| | |
|---|---|
| Superintendent's balance account, December, 1882 | $3,336 37 |
| Cash on hand December, 1882 | 3,176 26 |
| Bullion on hand December, 1882 | 12,610 07 |
| Assessments (Nos. 43, 44, 45) | 252,000 00 |
| Gross bullion product | 33,500 00 |
| Cash overdraft (December, 1883) | 28,661 71 |
| Bullion samples | 10 91 |
| Total | 333,295 23 |

| | |
|---|---|
| The ledger balance shows a total expenditure of | $359,371 40 |
| Receipts (assessments) | $252,000 00 |
| Gross product | 33,500 00 |
| General revenue and expenses | 45,209 69 |
| Cash | 28,661 71 |
| Total | 359,371 40 |

The Mexican mine.—The joint Ophir winze on the 2,900-foot level, which was sunk 162 feet in 1882, reached the 3,100-foot level in July, 1883, as stated in the Ophir report, when a main drift was started north and run across the Mexican ground a distance of 600 feet to the south line of the Union Consolidated Company's mine.

In September, 1883, a drift was started east about the middle of the mine on the 3,100-foot level. It was advanced 28 feet when the diamond drill was run ahead and so much water encountered that work was discontinued. The same month a cross-cut was started west and run a distance of 24 feet. When in 8 feet this drift cut into quartz assaying from $2 to $6 per ton. The diamond drill was put in and showed the same material ahead as far as it was run. The drill working badly and the assays being unreliable, the drilling was discontinued to await the connection of the main north drift with the Union Consolidated. No water was found by the drill.

On the 2,900-foot level a drift was run north to the Union Consolidated line, a distance of 600 feet, bringing the air down to this level. In May an upraise was started from the 2,900-foot level for the 2,700 foot level, with which it connected in October. An east cross-cut joint with the Union Consolidated was started in the beginning of 1883, and run on the line of the two mines a distance of 243 feet, when the diamond drill was put ahead and so much water found that work was discontinued. All the hoisting of rock and pumping is done at the joint Union Consolidated, Mexican and Sierra Nevada shaft, commonly known as the Union shaft.

Aggregate assessments of $3 per share were made during the year.

Following is the financial statement for the year:

RECEIPTS.

| | |
|---|---|
| Balance from last year | $69 92 |
| From other mines | 514 50 |
| From San Francisco office, sundry drafts on president | 289,869 36 |
| Total | 290,453 78 |

DISBURSEMENTS.

| | |
|---|---|
| Salaries and wages | $89,981 68 |
| Supplies and miscellaneous expenses | 109,349 34 |
| Sierra Nevada, Mexican, and Union Shaft Company | 86,558 13 |
| Legal expense | 416 66 |
| Exchange | 1,437 00 |

| | |
|---|---|
| Milling | $2,469 36 |
| Royalty on ore | 154 37 |
| Gross expense | 290,366 51 |
| Balance cash on hand | 87 27 |
| Grand total | 290,453 78 |

Sierra Nevada mine.—The pumping and hoisting of the Sierra Nevada is done at the joint Union shaft, of which this company owns one-third. During 1883 an east cross-cut was started 800 feet north of the south line on the 2,700-foot level and run 174 feet. From the end of this drift a diamond-drill-hole was run east 230 feet, one northeast 280 feet, one southeast 185 feet, and another west from the main north drift, at a point opposite the east cross-cut, 235 feet. But little water was encountered in any of the holes, and the assays were from $2 to $5 per ton. On the 2,900-foot level the main north drift was extended 791 feet, and from the end of it a raise was made up to the 2,700-foot level. An east cross-cut joint with the Union Consolidated Company was made on the south line a distance of 287 feet. When in 130 feet this drift passed through 11 feet of ore, averaging $21 per ton. A drift was run north on this ore streak a distance of 60 feet, and the ore extracted was milled. Where work was discontinued the ore averaged $12 per ton. At a point 141 feet east of this ore vein a winze joint with the Union Consolidated mine was sunk to the 3,100-foot level. From the station at the bottom of this winze a joint cross-cut was run 28 feet, showing streaks of gold-bearing quartz assaying from $10 to $60 per ton, while selected samples assayed several hundred dollars. A northeast drift has been run from this point a distance of 120 feet, following the greater part of the way the same streaks of ore that were cut in the joint east cross-cut. The secretary's report for the year is as follows:

RECEIPTS.

| | |
|---|---|
| Cash on hand last annual statement | $50,234 82 |
| Balance of assessment No. 75, levied December 8, 1882 | 12,260 00 |
| Assessments Nos. 76 and 77 | 200,000 00 |
| From other mines for labor and supplies | 40,092 68 |
| Sale of Eureka mill and supplies | 25,370 35 |
| Total | 327,957 85 |

DISBURSEMENTS.

| | |
|---|---|
| Salaries and wages | $107,620 95 |
| Mine supplies | 23,824 19 |
| Wood | 60,369 75 |
| Lumber | 2,605 18 |
| Freight | 4,231 99 |
| Pumping and hoisting | 7,840 75 |
| Water and ice | 23,813 53 |
| Legal expense | 926 97 |
| Interest and exchange | 1,132 81 |
| Eureka mill expense | 102 44 |
| Eureka mill insurance and taxes | 1,799 25 |
| Taxes on mine, land, &c | 2,185 50 |
| Sierra Navada, Mexican, and Union Shaft Company one-third expense | 89,410 59 |
| Virginia office expense | 286 18 |
| San Francisco office, books and stationery | 136 60 |
| Advertising | 114 20 |
| Office rent and miscellaneous expenses | 1,431 60 |
| Total | 327,832 48 |
| Cash on hand | 125 37 |
| Grand total | 327,957 85 |

The superintendent's report shows the following:

RECEIPTS.

| | |
|---|---|
| From other mines | $40,092 68 |
| Eureka mill supplies sold | 370 35 |
| San Francisco office, drafts on president | 279,362 65 |
| Total | 319,825 68 |

DISBURSEMENTS.

| | |
|---|---|
| Salaries and wages | $102,520 95 |
| Mine expense | 23,824 19 |
| Office expense | 286 18 |
| Legal expense | 403 47 |
| Wood | 60,369 75 |
| Lumber | 2,605 18 |
| Hoisting | 7,840 75 |
| Hauling | 4,231 99 |
| Water and ice | 23,813 53 |
| Union shaft, one-third net expense | 89,410 59 |
| Taxes | 2,055 50 |
| Eureka mill, taxes, &c | 1,406 69 |
| Exchange | 1,050 91 |
| Total | 319,825 68 |

Two assessments were made during the year aggregating $200,000.

Union Consolidated mine.—During 1883 a joint Sierra Nevada east cross-cut was run a distance of 287 feet on the 2,900-foot level, and a joint winze was sunk to the 3,100-foot level. On the 3,000-foot level a station was opened and about 250 feet of exploring drifts were run in Union Consolidated ground, showing 60 feet of quartz and 10 feet of paying ore. On the 3,100-foot level two working stations were excavated, one on the east and the other on the west side of the winze, and 600 feet of main south drift run to connect with the main drift north on the same level in the ground of the Mexican Company. The material on the 3,100-foot level is quartz, clay, and porphyry. In the stations and drifts are streaks of very rich gold-bearing quartz. The rock is hoisted and the water pumped at the joint Union Consolidated, Sierra Nevada, and Mexican shaft, generally called the Union shaft. The pumps at this shaft raise to the Sutro Tunnel level 1,400,000 gallons (6,000 tons) of water in twenty-four hours. The air moves through the main drift on the 3,100-foot level with a velocity of 7½ miles an hour, furnishing 20,000 cubic feet of fresh surface air per minute.

This 3,100-foot level is the deepest point in the earth where native gold has been found visible in the quartz, and some samples of ore have assayed as high as $1,000 in gold with a very small proportion of silver. The following financial statement is from the superintendent's annual report:

RECEIPTS.

| | |
|---|---|
| Balance from last statement | $1 95 |
| From other mines, for labor, &c | 61,596 25 |
| From San Francisco office, drafts on the president | 353,610 57 |
| Total | 415,208 77 |

DISBURSEMENTS.

| | |
|---|---|
| Salaries, exchange, &c | $5,388 94 |
| Labor, supplies, &c | 266,481 16 |
| Union shaft, one-third net expense | 102,790 81 |

| | |
|---|---|
| Reduction of ore | $30,210 57 |
| Legal expenses | 1,610 25 |
| Taxes | 5,709 27 |
| Sutro Tunnel, royalty on ore | 2,968 86 |
| Total | 415,159 86 |
| Balance cash on hand | 48 91 |
| | 415,208 77 |

| | |
|---|---|
| Gross expense | $415,159 86 |
| Received for labor, &c | 61,596 25 |
| Net expenses | 353,563 61 |

Consolidated Virginia.—During the year 1883, on the 2,500-foot level the southeast drift was extended to a point within 110 feet of the south line, when so much water was encountered that work was discontinued.

On the 2,700-foot level they resumed sinking the joint California winze in April, 1883, but when it had attained a depth of 122 feet below the level the influx of hot water was so great that work was stopped. A second joint California winze was started further east, and this has been carried down to the 2,900-foot level, a distance of 200 feet. A drift was also run 77 feet east on this level.

All the pumping and hoisting is done at the C. and C. shaft. The water of the Consolidated Virginia and California mines pumped to the Sutro tunnel level amounts to 850,000 gallons each twenty-four hours.

The financial report for the year is as follows:

| | | |
|---|---|---|
| Salaries and wages | | $44,503 44 |
| Transportation and hauling | | 68 77 |
| Assay office expenses | | 9,193 08 |
| Suction fan | | 345 00 |
| Office expenses | | 594 74 |
| Legal expense | | 588 90 |
| Interest and exchange | | 883 38 |
| Hoisting | | 2,619 15 |
| Sundry supplies | $4,456 74 | |
| Timber | 1,666 27 | |
| Ice | 10,639 73 | |
| Powder, caps, and fuse | 1,583 89 | |
| Oils | 276 31 | |
| Candles | 1,043 80 | |
| Hardware and drill fittings | 2,029 67 | |
| Compressed air | 17,553 52 | |
| Water rent | 50 00 | |
| | | 39,299 93 |
| State and county taxes | | 896 25 |
| Proportion of ore proceeds | | 1,076 22 |
| Half expense C. and C. shaft | | 79,950 00 |
| January 1, 1884, cash on hand | | 1,659 25 |
| | | 181,678 11 |

The secretary's report for the year is as follows:

RECEIPTS.

| | |
|---|---|
| From assessment No. 19 | $107,707 40 |
| Assay office (Virginia, Nev.) | 873 80 |
| Suction fan (Virginia, Nev.) | 9 50 |
| Balances outstanding last annual meeting, since settled | 97,168 23 |
| Proceeds settlement of bullion worked on joint account with other mines, fiscal year, 1881 | 8,455 56 |
| | 214,214 4 |

DISBURSEMENTS.

| | | |
|---|---|---|
| Nevada Bank, balance on hand | $36,643 76 | |
| Cash in San Francisco office | 216 35 | |
| W. H. Patton, superintendent, cash in Virginia, Nev | 1,659 25 | |
| | | $38,519 36 |
| Virginia office | | 594 74 |
| Hauling | | 68 77 |
| Books and stationery | | 291 75 |
| Advertising | | 504 00 |
| Water | | 50 00 |
| Hoisting | | 2,619 15 |
| Taxes | | 1,500 87 |
| Compressed air | | 17,553 52 |
| Bullion discount | | 159 93 |
| Interest and exchange | | 882 48 |
| Legal expense | | 2,324 75 |
| Supplies | | 14,293 43 |
| C. and C. shaft | | 79,950 00 |
| Salaries and wages | | 51,103 44 |
| Expense (San Francisco office) | | 3,798 30 |
| | | 214,214 49 |

One assessment of 20 cents a share was made during the year.

The California mine.—The work in this mine during the year was all on and below the 2,700-foot level. A winze joint with the Consolidated Virginia was started and abandoned at the depth of 122 feet, when a second joint was opened further east and sunk to the 2,900-foot level, where it will be connected with the main lateral drift. The winze was sunk in a mixture of quartz, clay, and porphyry. On the 2,900-foot level the main south drift was taken up at the Ophir line and run 450 feet. A west cross cut joint with the Ophir was run in March a distance of 40 feet. The diamond drill was then put in and a bore was run 350 feet further, all of the way in vein material. A joint Ophir east cross-cut was also run a distance of 23 feet. The pumping and hoisting is done at the C. and C. shaft. In both this mine and the Consolidated Virginia there has been great trouble on account of water, and a great amount of work has been done in making needed repairs at various points. The water of the California and Consolidated Virginia pumped to the Sutro tunnel level at the C. and C. shaft amounts to 850,000 gallons each twenty-four hours.

The total depth of the C. and C. shaft is 2,530 feet, 30 feet of it being sunk.

The financial report for the year ending December 31, 1883, is as follows:

RECEIPTS.

| | |
|---|---|
| January 1, 1883: | |
| Cash on hand in bank | $622 20 |
| Receipts from various sources | 4,104 18 |
| Samples on hand | 15 40 |
| Drafts on secretary | 178,600 00 |
| | 183,341 78 |

DISBURSEMENTS.

| | |
|---|---|
| Salaries and wages | $49,631 57 |
| Hoisting | 7,478 68 |
| Water and ice | 11,587 96 |
| Timber | 1,858 00 |
| Powder, caps, and fuse | 2,334 49 |
| Candles | 1,114 20 |
| Taxes, State and county | 153 36 |
| Bullion tax for quarter ending December, 1882 | 12 14 |

| | |
|---|---|
| Oils | $325 45 |
| Hardware and fittings | 2,583 20 |
| Compressed air | 22,209 73 |
| Sundry supplies and assaying | 1,298 11 |
| Office expenses | 11 00 |
| Legal expenses | 475 90 |
| Proportion of ore proceeds | 866 15 |
| Half expense C. and C. shaft | 79,950 00 |
| Interest and exchange | 1,038 99 |
| | 182,928 93 |
| January 1, 1884: | |
| Cash on hand in bank | 397 45 |
| Samples on hand | 15 40 |
| | 183,341 78 |

### FINANCIAL STATUS OF C. AND C. SHAFT.

| | |
|---|---|
| January 1, 1883: | |
| Balance in bank | $644 23 |
| Received from Consolidated Virginia Mining Company | 79,950 00 |
| Received from California Mining Company | 79,950 00 |
| | 160,544 23 |
| January 1, 1884: | |
| Balance in bank | 272 33 |
| Actual cost | 160,816 56 |

Gould and Curry mine.—This mine is worked through a shaft-joint with the Best and Belcher, known as the Osbiston shaft. The shaft is 2,500 feet in depth, and is supplied with hoisting and pumping machinery of sufficient capacity to work to a depth of 3,000 feet. During the year about 900,000 gallons of water have been raised to the Sutro Tunnel level every twenty-four hours. During the year 1883 the work was confined to the 2,500-foot level. A west cross-cut on the south line was run 688 feet through hard, barren ground, and a drill-hole from the end of this drift was run a further distance of 150 feet, tapping the west water. In the central part of the mine a second west cross-cut was run 629 feet, all the way through hard, barren rock. From the end of this drift a drill-hole was run 80 feet, and nothing of value found. From the results of these explorations it is concluded that the old, or west vein, does not extend to the 2,500-foot level. On the north boundary line a drift was run east, jointly with the Best and Belcher Company, a distance of 184 feet, showing a well-defined vein formation about 100 feet in width. This formation contains streaks of quartz giving low assays. Near the middle of the mine a second cross-cut was run east a distance of 262 feet, showing the same formation that was found in the drift east, joined with the Best and Belcher Company. A third east cross-cut was run near the south line of the mine a distance of 277 feet, passing through the extension of the vein formation mentioned above, but showing nothing of value, the quartz not reaching so far south. On the 25th of October a vertical winze was started 10 feet west of the west clay of the vein in the joint Best and Belcher east drift. This winze is being sunk jointly with the Best and Belcher Company, and is down 190 feet. It will be sunk to the 2,700-foot level. At its present level it is in bird's-eye porphyry.

The old Bonner shaft is being retimbered and repaired, and explorations will be made on the north end of the mine in ground that was hastily passed over in the early days. Work is also being done by way of the old Potosi tunnel, and the Virginia City and Gold Hill Water Company is working on the lower tunnel. Three assessments of 50 cents a share were made during the year. The secretary's statements were as follows:

RECEIPTS.

| | | |
|---|---|---|
| Cash on hand as per statement December 18, 1882 | | $19,114 79 |
| Assessments: | | |
| No. 44, on 108,000 shares, 50c | $54,000 00 | |
| No. 45, on 108,000 shares, 50c | 54,000 00 | |
| No. 46, on 2,116 shares, 50c | 1,058 00 | |
| | | 109,058 00 |
| Mine account: | | |
| Sale sundry supplies | | 3,681 43 |
| Balance: | | |
| Cash indebtedness | | 17,277 22 |
| | | 149,131 44 |

DISBURSEMENTS.

| | |
|---|---|
| Mine supplies | $1,888 66 |
| Wood | 1,372 80 |
| Labor and salaries | 9,993 83 |
| Joint shaft, G. & C. and B. & B., one-half expense | 127,438 08 |
| General expenses | 8,438 07 |
| | 149,131 44 |

Best and Belcher mine.—Most of the work in this mine during the year 1883 was carried on jointly with the Gould and Curry Company. The work is done through the same shaft, the Asbiston, and all the work has been on the 2,500-foot level. During the year a drift was run north toward the Consolidated Virginia, a distance of 560 feet, and discontinued in wet ground. A drift was also run northwest 480 feet and discontinued. The ground north is very wet and operations will not be renewed in that part of the mine until the ground is drained by work done on the Consolidated Virginia side of the line. As mentioned in connection with the Gould and Curry mine, a winze joint with that mine is being sunk to the 2,700-foot level. The joint east drift on the level shows a vein formation 100 feet in width making north into the Best and Belcher ground. All the water is pumped to the Sutro tunnel at the Asbiston shaft, and by that shaft all the rock is hoisted to the surface.

The Yellow Jacket mine.—The water in this mine flooding everything to a depth of 1,168 feet above the 3,000-foot level, remains stationary, and all work done has been on the upper levels. On the 190-foot level near the north boundary good ore has been found, and the 360-foot level was reopened. On the 452-foot level a winze has been sunk, and the 552-foot level has been connected with this winze. In all 3,472 feet of drifts have been run during the year, and much dead work done in retimbering, &c. The mine is being worked from the 800-foot level upwards, taking out from 100 to 125 tons of ore per day. The secretary's report shows the following:

RECEIPTS.

| | |
|---|---|
| Balance on hand July, 1882 | $71,605 90 |
| Bullion produced | 440,875 99 |
| Received from rents | 240 00 |
| Sale of 18,740 shares of company's stock for non-payment of assessment No. 44 | 28,622 31 |

| | |
|---|---|
| Received from Alpha Consolidated Mining Company | $1,218 42 |
| Received from Bullion Combination shaft | 3,025 00 |
| Received from sale of material | 3,104 55 |
| Received from sale of 235 shares of company's stock | 939 50 |
| Total | 540.631 67 |

### DISBURSEMENTS.

| | |
|---|---|
| Pay-roll of employés | $108,422 50 |
| Salary of officers | 11,650 00 |
| Expense bills | 1,520 03 |
| Exchange on money | 6 10 |
| Legal expense | 2,886 40 |
| State, county, and town tax | 5,051 36 |
| Mine supplies | 39,515 80 |
| Milling ores | 185,084 32 |
| Assaying ores and bullion | 3,695 02 |
| Insurance | 2,700 00 |
| Charity | 60 25 |
| Discount and freight on bullion, including bullion tax | 55,786 98 |
| Advertising | 220 00 |
| Sutro tunnel Company | 12,242 09 |
| Total | 428,840 85 |
| Balance on hand | 120,790 82 |

### ASSETS.

| | |
|---|---|
| Cash | $120,790 82 |
| Consolidated Imperial Silver Mining Company | 3,050 89 |
| Fulton foundry | 15 92 |
| Supplies on hand | 2,204 08 |
| Sutro tunnel Company | 62,917 62 |
| Total | 188,979 62 |

Hale and Norcross mine.—During the year the work in this mine has been principally confined to the 2,600 and 2,700 levels. There have been excavated 2,182 feet of drifts and 413 feet of winzes. The principal winze extends from the 2,600 to the 2,800 level, where the ore strata become more vertical and turn to the west toward the Keating vein. The shaft is 2,400 feet deep, but the rock is raised and the water pumped at the joint Chollar-Norcross-Savage shaft, commonly known as the "Combination shaft." The hydraulic pumping machinery of this shaft when running steadily raises 3,600,000 gallons of water to the Sutro Tunnel level each twenty-four hours. The formation from the 2,600 level down to the 2,800 level is quartz, clay, and porphyry, with occasional streaks of paying ore. The mine is worked in conjunction with the Savage, but no new openings were made in the latter during 1883.

In November the mine had on hand cash to the amount of $4,443.70, and the amount due on assessment No. 78 was $9,881.50. Four assessments of 50 cents a share were made during the year.

The Keyes and Wheeler mine.—This mine has not been known until this year. A narrow vein of ore was found at a depth of 225 feet. The vein dips to the east at an angle of 37°, and the ore shows black sulphurets and chloride of silver. Assays have gone as high as $26,000 per ton. Works are being erected and it is expected that during the next year it will add materially to the bullion output of the district.

The Kentuck mine.—This mine, as well as all the mines of the Gold Hill group, has been worked down to the 3,000-foot level, but with them is now flooded to a depth of 1,500 feet. The workings are confined to the old ground above the 1,200 level, and averages about 80 tons of ore per day. Nine dividends to the total amount of $27,000 have been declared.

The Crown Point mine.—This mine, being flooded to a depth of 1,500 feet, is being worked from the 1,600-foot level up, from 120 to 150 tons of ore per day being taken out. The low water of the Carson River seriously interfered with the working of the mills during the summer, and in December the hard freezing at night in the mountains again reduced the suppy of water at the river mills.

Chollar and Potosi mines.—These mines are being worked jointly. During the past year they have run 2,960 feet of drifts and cross-cuts, all of which was on the 2,630-foot level. These drifts were very large, being 8 feet wide at the bottom, 7 feet at the top, and 8 feet high. They have also run 360 feet of diamond-drill holes on the same level. The ground explored has been a mixture of quartz, clay, and porphyry. In connection with the Hale and Norcross and Savage Companies they have made an upraise from the 2,630-foot level 115 feet in height and 6 feet by 10 in size, connecting with the level above. Also, in connection with the same companies, they have excavated at the 2,630-foot level a tank station 65 feet long, 10 feet deep, and 10 feet wide. At the same point has been excavated a pump station 82 feet long, 27½ feet wide, and 14 feet 4 inches high. In this station they have placed and put in operation a hydraulic pump of a capacity to raise 2,500 gallons of water per minute to the Sutro Tunnel level, 1,035 feet above, in one lift. At the 2,400-foot level they also have a hydraulic pump of the same capacity. These pumps raise to the Sutro Tunnel all the waters of the Savage, Hale and Norcross, Chollar, and Potosi mines.

Scorpion mine.—During 1883 drifting to the extent of 600 feet was done on the 500-foot level, the formation being porphyry with occasional streaks of clay and porphyry. The shaft is 1,000 feet deep, but no pumping has been done during the year. Three assessments of 10 cents per share were made in the twelve months.

Alta mine.—The only new work done in 1883 was to run a drain drift from the 1,030-foot level of the shaft to the Sutro Tunnel, a distance of 2,400 feet. The remainder of the time was occupied in draining the mine, which was flooded up to the 1,100-foot level. The shaft is 2,150 feet deep. The amount of water pumped in twenty-four hours from the 2,150-foot level is 604,800 gallons. Four assessments of 25 cents per share were made during the year.

I am under obligations to Mr. J. Minor Taylor, of Virginia City, not only for information in regard to the operations during the year in the Mexican, Ophir, California, Sierra Nevada, Consolidated Virginia, Gould and Curry mine, but also for a statement of specific amounts of gold and silver respectively obtained from the following mines:

| Producing mines. | Gold. | Silver. | Total. |
|---|---|---|---|
| Ophir | $28, 150 | $16, 890 | $45, 040 |
| Union Consolidated | 13, 567 | 7, 254 | 20, 821 |
| Mexican | 2, 795 | 1, 144 | 3, 939 |
| Tailings mills | 10, 993 | 94, 416 | 105, 409 |

Mr. J. C. Corey gives the following as the proportions of gold and silver produced from the mines and mills of the district:

| Producing mines. | Gold. | Silver. | Total. |
|---|---|---|---|
| Potosi Mining Company | $135,864 57 | $156,843 75 | $292,708 32 |
| Union Consolidated Mining Company | 8,953 20 | 11,868 21 | 20,821 41 |
| Belcher Mining Company | 99,557 96 | 120,344 28 | 219,902 24 |
| Crown Point Mining Company | 217,957 78 | 265,664 95 | 483,622 73 |
| Chollar Mining Company | 6,031 55 | 7,995 33 | 14,026 88 |
| Challenge Mining Company | 5,284 28 | 10,845 50 | 16,129 78 |
| Confidence Mining Company | 1,306 67 | 1,732 11 | 3,038 78 |
| Kentuck Mining Company | 120,650 63 | 136,676 42 | 257,327 05 |
| Yellow Jacket Mining Company | 201,395 34 | 243,710 09 | 445,105 43 |
| Lady Bryan Mining Company | 5,051 84 | 7,626 87 | 12,578 71 |
| Imperial Consolidated Mining Company | 3,351 74 | 4,443 01 | 7,794 75 |
| Monte Christo Mining Company | 7,994 66 | 10,132 47 | 18,127 13 |
| Ophir Mining Company | 21,367 37 | 23,673 03 | 45,040 40 |
| Andes Mining Company | 740 40 | 981 54 | 1,722 00 |
| Savage Mining Company | 789 75 | 595 25 | 1,385 00 |
| From tailings | 888 24 | 5,920 98 | 6,809 22 |

The following is the assessor's report showing the product and cost of operating the mines of Storey County during 1883:

ORES.

| Name of mines. | No. tons extracted. | Gross yield. | Total cost. |
|---|---|---|---|
| Andes | 123 | $1,722 00 | $1,359 65 |
| Belcher | 12,230 | 219,902 24 | 211,386 27 |
| Crown Point | 40,544 | 483,622 75 | 464,442 01 |
| Kentuck | 11,094 | 257,327 05 | 210,722 25 |
| Lady Bryan | 1,680 | 9,760 00 | 9,480 21 |
| Monte Christo | 1,250 | 15,427 13 | 14,316 61 |
| Ophir | 4,728 | 45,040 40 | 77,160 46 |
| Potosi | 22,058 | 292,708 32 | 288,951 19 |
| Savage | 118 | 1,358 00 | 1,711 00 |
| Union Consolidated | 1,163 | 20,821 41 | 162,468 66 |
| Yellow Jacket | 29,556 | 445,105 43 | 510,508 21 |
| Confidence | 217 | 3,038 78 | 3,090 75 |
| Challenge | 1,059 | 14,026 88 | 16,127 00 |
| Consolidated Imperial | 554 | 7,794 75 | 8,553 25 |
| T. Huley | 325 | 1,868 70 | 1,862 50 |
| W. Rodda | 300 | 2,700 00 | 2,700 00 |
| W. Roe & Co | 150 | 1,050 00 | 1,125 00 |
|  | 127,149 | 1,823,273 84 | 1,985,965 02 |

TAILINGS.

| | | | |
|---|---|---|---|
| B. Pfeiffer | 720 | 1,440 00 | 702 00 |
| Mariposa mill | 933 | 4,480 98 | 5,973 32 |
|  | 1,653 | 5,920 98 | 6,675 32 |

The amount carried out of the county by Wells, Fargo & Co., together with that received at the Carson mint from other sources amounted to $2,492,721, showing that $663,526.34 more was taken out of the county than the gross yield as reported by the assessor.

I have placed the production of this county at—gold, $1,600,000; silver, $900,000; a total of $2,500,000. This is an increase of about $750,000 over last year, and places Storey County once more as the largest producer in the State.

## WASHOE COUNTY.

The assessor of Washoe makes no report of any product for the year 1883. Wells, Fargo & Co. report that they carried bullion from the county and the mint that it received deposits, the sum of the two being $20,804. It is possible that this should be credited to some adjoining county or counties. It is learned, however, that prospecting was carried on, and many mining claims developed and sold.

In *Argentine district* the Harris mine, 3 miles from Washoe City, promises to become a valuable property. The lode, as far as prospected, carrying free gold, and two small sacks of ore were sold in Virginia City for $1,300.

In *Pyramid district* a tunnel was run in the Jones and Kinkead mine. The most promising mine has been the Pyramid. The ore from it greatly resembles the Comstock quartz, containing copper and silver, with some sulphur.

In *Pevine district* the Golden Fleece mine was opened by a tunnel and work begun on it in November.

I have placed the production at—gold, $15,000; silver, $10,000; a total of $25,000.

## WHITE PINE COUNTY.

There was a reduced production in this county during 1883, owing to the falling off in some of the old mines. Some new fields have been discovered, but have not added materially to its production.

*Cherry Creek district.*—The usual amount of work was done on the mines of this district, the Star mine remaining the largest bullion producer.

*Ward district.*—In this district the Martin White is still the leading mine, and the work during the year has been mainly confined to the upper levels, developing the ore veins and seams near the old bodies, and working out the old tunnels and drifts, so that they may be abandoned, and no further expense incurred in retimbering and keeping them open. The ore extracted has ranged in value from 30 ounces to 200 ounces per ton, and small lots were found assaying as high as 5,000 ounces per ton, some of it nearly all horn silver, and one piece of it weighing 35 pounds. This very rich ore was found within 15 feet of the surface.

The following extract from the report read at the annual meeting in September shows the financial condition of the company:

### RECEIPTS.

| | |
|---|---|
| Mill bullion | $107,010 71 |
| Furnace clean-up | 169 18 |
| Assessments Nos. 13, 14, and part of No. 15 | 58,990 00 |
| Real estate received for rent | 130 50 |
| Timber | 518 29 |
| Wood | 96 53 |
| Draft account | 2,181 42 |
| Total | 169,096 63 |

### DISBURSEMENTS.

| | |
|---|---|
| Draft account; paid superintendent's drafts outstanding August 1, 1882 | $6,987 47 |
| Mine cost | 200 00 |
| Office furniture | 50 00 |
| Salt | 5,092 50 |
| Quicksilver | 4,579 90 |

| | |
|---|---|
| Bullion charges | $2,989 30 |
| Mill expense | 40,298 69 |
| Office expense | 4,559 25 |
| Taxes and insurance | 3,436 22 |
| Interest | 1,931 46 |
| Hauling ore | 327 08 |
| Assessment work | 100 00 |
| Company's stock | 4,603 25 |
| Storehouse account | 3,794 22 |
| General expense | 9,157 45 |
| Mining expense | 73,356 78 |
| Superintendent's account | 51 28 |
| Cash overdraft August 1, 1882, as per statement | 7,539 90 |
| Balance cash on hand | 41 88 |
| Total | 169,096 63 |

STATEMENT OF S LIES ON HAND.

| | |
|---|---|
| Salt | $638 81 |
| Quicksilver | 9,815 65 |
| Litharge | 1,200 18 |
| Wood | 376 08 |
| Sundries | 16,482 58 |
| Total | 33,513 30 |
| Amount of ore on hand, 713½ tons, of an average assay value in silver of $61.90 | 44,182 30 |

The following board of trustees was unanimously elected: C. H. Stanyan, Annis Merrill, E. W. Sawyer, R. P. Clement, W. E. Norwood. The board organized by electing the following officers: C. H. Stanyan, president; Annis Merrill, vice-president; Anglo-California Bank, treasurer; W. B. Clement, superintendent; J. J. Scoville, secretary.

*Taylor district.*—To Mr. Briggs, of the Monitor Mill and Mining Company at Taylor, I am indebted for a review of the mines of the Taylor district:

This district is situated on the western slope of the Schellbourn range of mountains in White Pine County, Nevada, and is 100 miles east of Eureka, 60 miles east of Hamilton, and is 10 miles east of Ward, on the opposite side of Steptoe Valley from the latter place. The altitude of the mines is about 8,000 feet above the level of the sea, and 1,200 feet above the general level of Steptoe Valley.

The formation is lime and quartzite, cut with narrow belts of porphyry, and all resting upon a base of granite. This base of granite occurs in heavy masses on the surface about one-fourth of a mile below the mines (or farther down the mountain side). The general trend of the ore bodies is from the northwest to the southeast. The ore of the district is a chloride of silver, carrying a light trace of copper, also a trace of oxide of antimony and some iron, and is contained in a quartz gangue varying in hardness from the hardest flinty quartz to that of a much softer character.

The ore occurs in large chambers near the surface of various dimensions. These ore bodies generally lie flat, but at places assume an angle of near 45°, and are usually encountered in close proximity to the porphyry belts.

The principal mines of the district are the Monitor and Gore, owned by the Monitor Mill and Mining Company, consisting of Messrs. Briggs, Lyons, and McGill (unincorporated). These two mines during six months of 1883, commencing in May and ending in November, produced 2,478 tons of ore, which yielded $147,031.62.

The ore is reduced in a ten-stamp battery mill, with pan amalgamation, the whole run by water power and is situated 8 miles distant from the mines. The ore is worked raw, *i. e.*, without roasting, and generally works to from 80 to 85 per cent. of the assay value and produces bullion from 850 to 950 fine. During the cold weather of the winter months the mill has to close down on account of the water in the stream freezing up. This company is now (22d of January, 1884) working a small force, making further and satisfactory developments in their mines, and have out on their dumps, preparatory to starting their mill again as soon as spring opens, some 300 tons of ore.

The Argus Mill and Mining Company (unincorporated), owned by Messrs. Carothers and Aultman, the former of Taylor district and the latter of Canton, Ohio, have for their principal mines the Sunrise and Self-Cocker mines. From these mines there were extracted during the latter part of last year (1883) some 1,500 tons of ore of the assay value of from $60 to $90 per ton. These mines adjoin and lie parallel to the Monitor and Gore, and the ore they produce is very similar in all respects to that obtained from the last-mentioned mines. This company completed and started up on the 5th of this month (January, 1884) a fifteen-stamp mill, run by steam, and distant from their mines 7 miles. They are now vigorously extracting ore from their mines, and anticipate a long and successful run with their mill.

The Breech-Loader, owned by J. W. Hickson, has produced large quantities of high-grade ore, which has been shipped mostly to Salt Lake City for reduction. Sixteen tons of third-class ore from this mine, worked in the Monitor Company's mill last November (1883) as an experimental test, yielded $104 per ton.

The June mine, owned by Verzon, Murphy & Co., had 8 tons of their ore worked at the Monitor mill in November last, also as an experimental test, which yielded $200 per ton.

The Brown Bull, owned by R. W. Simpson, William Bothwick, and William Pride, is being systematically developed and is showing up large bodies of high-grade ore. This company contemplates the erection of proper reduction works.

Numerous other mines are in the district in different stages of development, all of which give good promise of rewarding their owners in a substantial manner in the future.

*White Pine district.*—I am indebted to Mr. W. Woodberry, of Hamilton, White Pine County, for the following estimates of the bullion product of the mines of the White Pine district for the year:

| Producing mines. | Total product. |
|---|---|
| Paymaster | $109,091 05 |
| Star | 34,335 83 |
| Monitor | 66,187 00 |
| Stafford | 10,897 60 |
| Bay State | 39,257 48 |
| Exchequer | 1,968 00 |
| Fair Play | 35,401 23 |
| Blue Bell | 2,728 00 |
| Rescue | 4,920 00 |
| Fort Wayne and Credit Mobilier | 1,708 00 |
| Smoky mill | 24,838 65 |
| Miscellaneous | 19,625 30 |

On Treasure Hill work was carried on in several mines.

In the Eberhardt mine the tunnel was pushed further and explorations made developing ore assaying from $70 to $700 per ton.

The Konigsberg and the Smoky mines were successfully worked, and the Sweetwater and Rescue were worked during part of the year.

In *Patterson district* a quartz ledge 6 feet thick, of rich chloride, was found. The ledge dips at an angle of 30°, and has a hanging wall of clay shale. Another ledge, 75 feet distant, dipping towards the first one, has been found, and may prove to be an off-shoot from the main body. Only prospecting near the surface has been done on the Patterson mine. Samples of ore have assayed at $94, and some of it as high as $1,200 and $1,500 per ton.

*Granite district.*—This district is 20 miles south of Cherry Creek, in the Egan range, and the ledge is rich in native gold. Gotchett and Judson have a two-stamp mill at work prospecting in Telegraph Cañon, and enough ore has been worked to pay all expenses.

*Aurum district.*—In this district the principal mines are the Sadie L. and the Blue Belle. In the former the ledge is 10 feet wide and the ore a rich carbonate.

In the *Silver Glance district* the Orpheus mine has produced some rich ore, one lot of 6 tons yielding 60.80 ounces of gold.

In the *Lexington district*, located in the southeastern part of White Pine County, a shaft has been sunk 50 feet on the gold ledge, the ore found assaying from $20 to $70 per ton, without any dead work being done in extracting it. As there is sufficient water for all mining purposes, it is expected that the aid of capital will soon reopen the old mines.

*Osceola.*—At Osceola, in the extreme southeastern part of White Pine County, near the Utah line, placer and quartz mines were discovered during the year, and a small town sprang up. The country is well wooded, but water is not obtainable for mining purposes in any quantity, and during the summer the miners in the placers used rockers, and waited for the melting snow of the winter to work over the gravel more thoroughly. The largest nugget found is said to have weighed 25 pounds, and of pure gold. The ore is white quartz.

The Osceola Mining Company commenced hauling ore to the mill, 3 miles distant, in December. Thirty tons of ore were taken out daily, and there were 1,500 tons of ore on the dumps when the mill was started.

On the Bond Holder mine a shaft-house was built, and preparations made to begin work.

The Verdi mine is 3 miles south of Osceola. The shaft has been sunk 60 feet, and drifts and cross-cuts of 400 feet on the ledge showed free gold quartz all of the way.

The Mazeppa mine is a ledge of free gold quartz running north and south, and is 600 yards northeast of the Verdi mine.

The Virginia Rose mine is 500 yards east of the Verdi mine, and the Durango mine is 350 yards west of the Verdi mine. The Durango ledge is of free gold quartz running east and west, and the shaft has been sunk 80 feet through a continuous ore body.

The Sperango mine, situated 700 yards southeast of the Verdi mine, is a well-defined ledge, with shaft sunk 40 feet, and a drift run on the ledge for 20 feet. The ore assays from a trace to $100 per ton.

At Monroe City, 4 miles from Osceola, quartz mining has also been commenced.

The placer fields of Osceola district cover an area of 10 by 7 miles, including several cañons. Miners in the gulches average $2.50 to $5 per day, and dust and nuggets pass current in trade. Want of water has retarded work in the placers, but negotiations are on foot for a water system which will convey it by a ditch, 18 miles, from Snake Valley. Great interest has been manifested in this new field.

The assessor's report of White Pine County showed the product of the mines during the calendar year 1883 to have been as follows:

| Mines. | Number of tons extracted. | Gross yield. |
|---|---|---|
| Paymaster | 2, 112 | $109, 091 05 |
| Star | 798 | 34, 335 83 |
| Monitor | 1, 875 | 66, 187 50 |
| Stafford | 800 | 10, 897 60 |
| Bay State | 1, 935 | 39, 247 48 |
| Exchequer | 114 | 1, 968 00 |
| Fair Play | 510 | 35, 401 23 |
| Blue Bell | 186 | 2, 728 00 |
| Fort Wayne and Credit Mobilier | 854 | 1, 708 00 |
| Rescue | 44 | 4, 920 00 |
| | 9, 228 | 306, 484 69 |
| Tailings, Smoky mill | 6, 133 | 14, 838 65 |

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[a] The production of this county was about $400,000, of which $50,000 was gold and $350,000 was silver.

# CHAPTER IX.

## NEW MEXICO.

The following descriptive review of the mines of this Territory was prepared by F. P. Gross, of my office, from information and reports obtained from all the principal counties producing gold and silver. While the mining industry of this Territory failed in some localities to fulfill the promise of previous years, its total production of the precious metals has steadily increased. In Grant County, heretofore the principal producer, new and important discoveries were made, and in some of the old mines rich deposits of ore bodies were uncovered, and in consequence, notwithstanding the apathy which existed in some of its mining camps, the production of the precious metals in Grant County was considerably greater than in 1882. This was due largely to the energetic development of the Kingston mines, a few of those in Steeple Rock district (notably the Carlisle), the operations of the Solid Silver Company, and the new discoveries at Fleming Camp, near Silver City, as well as the active working of some of the districts in the southern portion of the county.

The mining districts of Doña Aña County, with the exception of Hillsborough, were also successfully operated, and the product of the county was in consequence considerably augmented. The Gold Stamp mill, at Hillsborough, was in operation during the greater portion of the year, but owing to the refractory nature of the ore and lack of approved appliances, its operations were wasteful.

In Socorro County much was accomplished in the way of development, and at Socorro, the county-seat, the smelting works have been greatly enlarged and improved so that they are now the most complete reduction plant in the Territory. Some shipments from points on the Atchison, Topeka and Santa Fé Railroad were made of ores produced in the Black Range, but aside from these and the production of the Cooney mill, in the extreme western portion of the county, the production of the year was principally confined to the Magdalenas and other districts adjacent to Socorro, in consequence of which there has been a slight falling off from last year in the amount of bullion produced. This was also the case in Lincoln County, next east of Socorro, due principally to inadequate means of communication, and in some instances to the want of necessary capital to push development or procure requisite machinery. The remote districts of these counties have especially been retarded in their development by the former of these causes. The nearest point of railroad communication with White Oaks, the most important town of Lincoln County, is Socorro, distant about 120 miles. The best-developed districts are still further to the east and south of White Oaks, so that all supplies must be transported by teams from 125 to 140 miles. The wagon road from Socorro is rough and hilly, in consequence of which most of the supplies are transported by the still longer route from Las Vegas. The more distant districts of Socorro

County labor under similar disadvantages; it is not surprising, therefore, that mining as an industry has not progressed more rapidly.

While there are doubtless rich leads of both gold and silver in the mountains of Bernalillo County few mines have as yet been developed, and none of them explored to any considerable extent. Some enterprise has been exhibited, and the year's work will compare favorably with that done in previous years, but no report of production has been given, and it may be regarded as so small as to be of little consequence.

In the old districts of Santa Fé County the prevailing lack of enterprise and industry reduced the output of bullion, both in gold and silver, but new discoveries made in other portions of the county promise a better record for the future. The rich placers of this county and the inadequate supply of water with which to utilize them are still a problem, the solution of which a few intelligent, enterprising, and persevering gentlemen are laboring to solve. It is gratifying to be able to state that efforts made in this direction have been at least partially successful.

In the extreme northwestern portion of Rio Arriba County a fine mineral district was discovered during the year, and considerable preparatory work was done in the way of constructing reservoirs and erecting necessary buildings. This is reported to be a gold district, and that metal is found in both placers and leads. The development of the latter is said to be sufficient to warrant the building of a stamp-mill, which will probably be in operation early in the coming year. New discoveries of extensive placers are also reported from Las Vegas, in San Miguel County, but they were made so late in the year as to prevent the possibility of securing reliable data.

In Mora County considerable work has been done in the Poverty Hill Camp, but no output of bullion has been reported. Arrangements are, however, being made to supply necessary machinery and works, which may in the coming year bring this county into the list of bullion producers.

From the counties of Taos and Colfax, although some development work has been done, no report of production has been received; in fact, except in a few cases only, the prevailing lack of interest in mining enterprises already mentioned in connection with other localities has extended to these counties.

The yield in each shown in the following pages is an estimate, and is attributable to desultory labor in the placers rather than to any systematic or intelligent operations in connection with the lead mines of the various mining districts.

It is a fact to be regretted that quite a number of smelters in various portions of the Territory, some of which commenced business under most flattering auspices a year or two ago, have not been in blast during the year, and a few mills have also lain idle except at short intervals during the same period. These interruptions have been in some instances due to legal difficulties, in others to faulty construction or inadequate machinery, again to the fact that the works were not adapted to the ores for the treatment of which they were erected, and sometimes to a lack of ore necessary to keep the works employed. But the enforced idleness seems in nearly every case to have resulted from hasty and ill-considered action. The misfortune is the greater, because all these reduction works, and many more, are greatly needed to treat the ores of numerous mining districts that are retarded in their development by the want of such works as are now rapidly going to decay through the unwise action of their projectors.

It is gratifying to be able to state that with the increase and growing importance of this branch of the Territory's industry, railroads are being gradually pushed forward to the principal mining centers. Necessity, too, will doubtless soon compel communication with its extensive coal-fields to be opened, and when this is finally accomplished we may reasonably look forward to a prosperous future for this extensive mineral-bearing section.

I estimate the production of New Mexico during the year 1883 to have been $3,125,000, of which amount $280,000 is estimated to be gold, leaving $2,845,000 as the value of the production of silver bullion, calculating it at its coining rate. Approximately the production by counties was as follows:

| Counties. | Silver. | Gold. | Total. |
|---|---|---|---|
| Grant | $1, 200, 000 | $110, 000 | $1, 310, 000 |
| Doña Aña | 1, 225, 000 | 85, 000 | 1, 305, 000 |
| Socorro | 400, 000 | 6, 000 | 406, 000 |
| Lincoln | 10, 000 | 24, 000 | 34, 000 |
| Santa Fé | 10, 000 | 15, 000 | 25, 000 |
| Colfax | ........ | 25, 000 | 25, 000 |
| Taos | ........ | 15, 000 | 15, 000 |
| Total | 2, 845, 000 | 280, 000 | 3, 125, 000 |

## BERNALILLO COUNTY.

But little is to be said of mining and mining matters in this county. The Sandia Mountains, northeast of Albuquerque, have long been known as a mineral section, but no mines of importance have yet been developed, though from time to time many promising prospects have been reported. The western portion of the county is but little known, and, owing to difficulty of access, has doubtless never been thoroughly prospected. Its rough and rugged mountain ranges present a fine prospecting field, which will not be overlooked, for careful exploration when more accessible districts cease to offer more flattering inducements.

In the Las Huertas Cañon, about 10 miles east of Bernalillo, an old Spanish mine (the shaft of which had been closed) has been opened and some 200 feet of old workings has been cleaned out. At least 1,000 superficial feet of apparently good pay-ore has been uncovered. When the work is finally completed the company proposes to furnish the shaft with necessary machinery and commence removing the ore. Other locations have been made in this cañon upon which sufficient work has not yet been done to warrant an opinion as to their value.

In July last a Mexican found a fine nugget of gold in the old bed of the Rio Grande, some 4 miles north of Albuquerque. The find resulted in considerable excitement and enthusiasm, and in a short time about one hundred and fifty men were busily engaged in staking off locations. A company was also formed which is now engaged in sinking a shaft. Whether this enterprise will be made to pay or not must yet be determined; but it appears to be an established fact that gold in considerable quantities is distributed in the sands around Albuquerque and in the gravel of the old river bed. Evidences of this have been repeatedly found, notably several years ago, when the very suburbs of the town were staked into mining claims. The excitement upon this occasion was short lived, disappointment following quickly in its wake.

A discovery of a promising lead was recently made in Tjeras Cañon, about 16 miles east of Albuquerque, by a party of prospectors. The ledge is reported to be prominent, and crosses the cañon about 3 miles from its mouth. The vein is capped with iron for a depth of about 10 or 12 feet, penetrating which the ore body is at once encountered, and is said to be rich in gold and to improve as depth is gained.

## DOÑA AÑA COUNTY.

The mining industry of this county is principally confined to the Lake Valley district, in the northwestern corner of the county, and to the Organ Mountains in the central. The Jarilla district, about 25 miles east of the Organ Mountains, contains many fine prospects, which run high in copper and carry silver in considerable quantities. Still farther to the north, beyond Tulerosa, in the Sacramento Range, recent and most promising discoveries have been made. The Sacramentos are a continuation of the White Mountain Range in Lincoln County. It is reported that arrangements are being made to erect a smelter to treat the ores of a group of mines lying some 6 or 8 miles southeast of Tulerosa, which indicate considerable and satisfactory development.

Of the two principal districts of this county, the Organ Mountain has exhibited unusual activity. The old mines are being energetically worked, new ones constantly developed, and necessary machinery for the treatment of the ores put in place as rapidly as the limited capital of the district will permit. The Memphis is the most important and the only mine of this district that has hoisting and pumping machinery. For a considerable time during the year the mine was idle on account of the accumulation of water. In October last the pumps were put in operation, and the small pump alone now keeps the mine in working condition. The depth attained is about 150 feet, at which point the vein is unusually promising. With the present plant and double shifts of hands, it is estimated that this mine will produce from 25 to 50 tons of ore per day. The mine is located a short distance east of Organ City, where the Organ Mountain Mining and Smelting Company's smelter is being erected, and is expected to be completed before the close of the year, the engine and crusher being already in place. It will have two stacks, one of 30 tons capacity for copper, the other 40 tons for lead ores.

The Memphis can keep the copper stack constantly supplied for a long time, as 1,200 tons of ore are now on the dump, and ore has also been accumulated on the dumps from other mines. The ores of the Memphis are principally copper, and some contain native silver and free gold. Assays of $15 to the ton have been made from the latter.

The Short Cut, owned by the proprietors of the Organ City smelter, has been developed by shaft and incline to a depth of 180 feet, by drifts on the vein of about 100 feet, and by a 25 foot winze. At the depth attained the vein is 4 feet in width, carrying from 30 to 60 per cent. of lead and from $30 to $200 in silver to the ton.

The Black Quartz is owned by the same company. It adjoins the Short Cut on the west, and is opened by shaft and incline to a depth of 120 feet. The ore produced carries lead and iron, and about $30 to the ton in silver.

The same parties also own the Girard and Quaker City mines. The former lies next west of the Black Quartz, and has been developed by a 75-foot incline. The quality of its ore is similar to the Black Quartz. The Quaker City has a 20-foot shaft, and shows well in lead, copper, and iron.

The Silver Gem was located within the year, and has been developed by shafts and drifts to the extent of about 300 feet. The ore is a rich galena, carrying a heavy percentage of silver, black sulphuret in character; a shipment of nearly 15 tons giving an average of about $120 to the ton. Much higher assays have been had, and the mine is said to have paid all working expenses. The vein averages 4 feet in width and carries a pay-streak of from 18 to 20 inches.

The Shoo-fly, lying next to the Silver Gem, has had some 50 feet of development work done, producing some fine ore, 4 tons of which was shipped, and gave returns of $60 to the ton. It is regarded as a promising prospect.

The Jay Gould lies about a mile and a half from Organ City. It is opened by a shaft to a depth of 70 feet, and a cross-cut to the vein. The ore is a black and red oxide of copper, and indications show the body to be large.

The Toughnut is developed by a shaft 40 feet deep; the ore is a combination of sulphide and chloride of silver and galena carrying silver; assays running upwards of $425 to the ton have been reported. The vein is about 2 feet in width, 4 inches of which, lying next the foot-wall, is reported to give assays of $25,000 to the ton. A tunnel to cut this vein was driven during the year a distance of 100 feet, but at last accounts it had not been reached, doubtless owing to some error of judgment as to the angle of dip.

The Chippewa lies near the Jay Gould and has had some 75 feet of prospecting work done upon it. The ore is a fair copper carrying some silver.

A new location was recently made upon the east side of the mountain and some prospecting work done disclosing a wide rich vein of galena, which has given assays reaching $500 in silver to the ton.

The Rio Grande, Little Buck, Merrimac, Silver Star, and Undine, all promising claims, lie within 3 miles of Organ City. The first is opened by a shaft 70 feet deep and by short drifts upon the vein, which show it to average about 20 inches in width. The ore is copper, and carries from 50 to 100 ounces of silver to the ton. About 10 tons are now on its dump and much more uncovered in the drifts.

The Little Buck has been developed by seven prospect shafts, ranging from 12 to 60 feet in depth. The character of ore encountered is chloride and sulphide of silver. It is reported that the ore shipped by this mine during the year has averaged $800 to the ton in silver. One pocket is said to have produced $20,000 worth of ore of the character named, and one car-load of 14 tons returned over $1,000 to the ton. The vein occurs in a contact of lime and slate. The outcroppings indicate rich mineral deposits throughout the entire length of the claim.

The Merrimac adjoins the latter. A shaft 75 feet in depth has been sunk on the vein and a tunnel is now being driven to intersect the bottom of the shaft. The vein is about 3 feet wide, the pay-streak extending the entire width. The ore is carbonate in character, carrying copper and silver; assays from $500 to $1,000 to the ton in silver have been had. The ore produced yields about 20 per cent. copper.

The development of the Silver Star has been little more than prospecting. The few openings made on the vein, however, have shown good ore about 6 feet between walls, which carries a 22-inch pay-streak of sulphurets, similar to that of the Little Buck, of which it is an extension.

The Undine, which is near the Merrimac, is owned by Mr. Cunningham. At 15 feet he struck a quantity of native silver, just as rich as any found in the Little Buck.

The Little Maud lies between the Merrimac and Jay Gould and adjoins the Toughnut. The claim has five veins, all of which have been more or less prospected, showing good doloride and galena ores. A shipment gave returns of 67 ounces to the ton in silver from the galena, and the chlorides are rated still higher.

The Stephenson mine has been worked to a considerable extent during the past year. It is now under lease to the San Augustine Silver Mining Company. Ten men are at work on day and night shifts tunnelling from both ends of the claim. The ore in the breast of the south tunnel measures 6 by 8 feet of solid galena, carrying about $40 in silver to the ton. The north tunnel is in about 180 feet, and in a short time the bottom of the old 120-foot shaft will be reached. The mine is about 2 miles south of the town of Organ City, to which place its ore will be shipped for treatment. The Stephenson is the oldest mine in the county, having been worked successfully by the gentleman whose name it bears nearly forty years ago. If this property could be made to pay with nothing but the rudest of Mexican appliances, furnished with all the modern improvements for economically operating ores it should pay handsome dividends and profits.

The Mountain Chief is a location in Black Mountain, on the east side of the Organ range. Upwards of a year ago a pocket of iron ore was uncovered in this mine, which carried free gold in large quantities. Assays of some specimens ran as high as $150,000 to the ton, and occasioned intense excitement for a time, but the development was not pushed with energy until in June of this year, when gold in larger quantities was struck. It is reported that chunks of ore as large as a man can lift have been found which show leaf and free gold in large quantities.

The Saint Elmo is a neighboring location, and development has uncovered a good body of ore in all respects similar to that of the Mountain Chief. Assays of $12,800 to the ton have been obtained from some specimens, while average assays run as high as $210 to the ton. There are said to be some 25 tons of ore of this character upon the dump of this mine. It is developed by two shafts about 40 feet in depth, and a cross-cut connecting them.

Contiguous to the Saint Elmo is the Lula May, which has a vein about 5½ feet in width in a contact of lime and slate. The ore is a black oxide of iron, carrying free gold and running well in silver. It is developed by a vertical shaft to a depth of 12 feet on the vein, at which point an incline of 85 feet, following the dip of the vein, has been sunk. Prospecting work is being continued by two shifts of hands, and there are already some 25 tons of ore on the dump ready for shipment.

The Copper Duke is another promising mine of this section upon which much development has been done during the year, and a valuable gold strike is reported. Two shafts are being sunk upon its ground, the second having attained a depth of about 40 feet. Its ore is similar to that of the neighboring mines, and is found in a contact of lime and granite.

The Gibson mine, on the same mountain, is reported to be doing well. The development consists of a shaft down 70 feet upon which work was pushed by day and night shifts. The ore is a carbonate of copper and copper glance. No assay reports have been received.

The Silver Coin, Forest Queen, Independent, and Bunko are all promising locations on Bear Mountain. The work of development has not been extensive, but the ores exposed, like all the other mines of the camp, are strongly impregnated with gold and carry considerable silver.

About a mile south of Bear Mountain quite a number of locations have been made on what is known as Mineral Hill, and considerable development work has been done.

The Bonanza is opened by a shaft 50 feet in depth on the vein, which shows a fine body of high-grade ore that runs about $200 to the ton in silver. The Omega, Maggie Davis, Leek, and Mingo belong to the same group, but, except upon the Omega, little development work has been done. At a depth of 20 feet a fine lead between well-defined walls was struck in the Omega.

The Lady Hopkins is another location on Mineral Hill upon which considerable development has been made during the past year. A shaft 67 feet in depth was sunk upon a blind lead, and half way down the hill a tunnel was started which, at a depth of 100 feet, encountered the same lead. Still further down a second tunnel has been driven a distance of about 200 feet, but the vein was not intersected. It is believed, however, that when this tunnel is completed it will cut at least three good leads. The ore is an oxide, and shows both gold and silver in considerable quantities. In the gangue mass of one of the leads nickel occurs, and as depth is gained copper and metallic iron are found.

It is impossible to notice, even briefly, any considerable number of the mines of this extensive district. Upwards of a thousand locations have been made, and sufficient development has been done in every portion of the district to demonstrate the richness and great extent of its mineral deposits. From what has already been done, it is safe to say that Organ Mountain district is in a fair way to take high rank as a producer of the precious metals.

The distance from Organ City to the nearest point on the Atchison, Topeka and Santa Fé Railroad is about 15 miles, over a natural road excellent at all seasons of the year, so that the means of communication and for obtaining supplies are exceptionally good. Should the new smelter prove remunerative, it will incite capitalists to make other investments and remove the principal obstacle to the rapid development of the district, *i. e.*, the want of necessary buildings and machinery for hoisting and pumping purposes and for the storage and reduction of ores.

*Jarrilla district* lies eastward from the Organ Mountain some 25 miles. It is located in a range of mountains of the same name, and contains some very fine prospects, but as yet has not been extensively developed. The development on the Refugia, one of the most promising of these, consists of a shaft on the vein 25 feet in depth. Some of the ore from this mine has been transported to Mesilla for treatment by the small Mexican smelter located there, and is said to have yielded as high as $200 to the ton in silver. The ore is galena and carbonate of lead, carrying silver and some gold, and in addition the vein carries a large pay-streak of copper.

Considerable work has also been done on the Duntona and Paul Jones. The shaft of the former is down about 70 feet, all in ore, and the work is being vigorously pushed by double shifts of hands.

The vein of the Paul Jones carries about $40 of silver and about $25 in gold to the ton, and is being opened with considerable energy.

These are copper prospects.

The mineral section now in process of development is in the extreme southern portion of the range. A large number of claims have been located, upon which only such assessment work as is necessary to hold the location has been done. Among these are the Happy, Little Page, Jarrilla King, Jarrilla Queen, Monitor, Lookout Monitor, McArdle, London Boy, Hidden Treasure, Big Injun, Black Swan, Roundup, Ragman, Orphan Boy, and many others. The want of water will doubtless be a serious drawback in the development of this district, as, owing to its scarcity it sells at $3 per barrel. Wood for all purposes is abundant, and grazing is excellent. The range is about 10 miles in length, and is said to be remarkable for the number and magnitude of its iron and copper outcroppings. The base is a limestone formation, but the higher altitudes and main peaks are granite and trachyte, traversed by many porphyry dikes. Comparatively a small portion of this extensive region has yet been carefully prospected, and it may be a long time before it is thoroughly explored, owing to its great distance from the railroad and the consequent difficulty of communication, the expense of obtaining supplies, and, above all, the want of a sufficient supply of water. A railroad from El Paso, Tex., to White Oaks is under contemplation, which, when completed, will skirt this range, and doubtless stimulate prospectors, and eventually handsomely reward judicious locators for their risks and hardships.

*Lake Valley district.*—This district still continues in a flourishing condition. It has been claimed by some that the deposits or ore bodies are becoming exhausted; later reports, however, contradict this. The entire section, so far as developed, presents a singular formation. Few well-defined fissure or contact veins are found, but the ore instead appears in pockets or a system of bodies of greater or less extent, in some instances entirely disconnected.

The Sierra Grande, Sierra Bella, and Apache are the important properties of this district, the former being the most extensively developed. During the greater portion of the year a force of about one hundred and twenty-five men has been employed in mining ore and prospecting its ground for other deposits, and it is said that a section 1,000 by 250 feet in extent has been most thoroughly exploited. Numerous shafts varying from a few feet to 60 or 70 feet in depth have been opened, and ore bodies have been encountered in nearly all of them. More recently the work of prospecting has been done by the aid of the diamond drill, which is found to be far more economical. The bit of this drill is hollow; its core, in consequence, enables the miner to determine with accuracy the character of the formation through which it passes. In its fourth position, driven to a depth of 38 feet, a vein 7 feet thick was encountered and "No. 4 deposit" was demonstrated to be a continuous ore body for a distance of 50 feet to the eastward of the point where workmen are now employed. In different other positions the same results were obtained. Shaft No. 11 was opened during the year and has produced some excellent ore. Shipments from it to the extent of 165 tons are reported, which has given returns of 100 ounces in silver to the ton. Shaft No. 14 shows the ore body to be 11 feet thick, 6 feet of which is good milling ore and the remainder rich enough for shipping purposes, and the indications are that the body will open still larger as work progresses. No. 18 is another new shaft, in which some very fine ore is reported to have been discovered. This shaft is opened between Nos. 7 and 11 and is said to demonstrate that the ore body tapped by these is a continuous one. Still other openings have been made during the year at different points of the ground of this claim, which are said to prove beyond a doubt its great extent and richness.

The Sierra Grande Company, which not only owns the mine of the same name, but the Sierra Plata and Apache as well, has erected a twenty-stamp mill during the year, a trial test of which shows that ore containing only 10 ounces of silver to the ton can be profitably treated. Only the higher grade ores, running from 50 ounces upwards, have heretofore been shipped ; the consequence is that immense masses of ore running less than 50 ounces have accumulated on the various dumps. The capacity of the mill is from 60 to 75 tons per day and it is likely that it will be increased to 100 tons by the addition of ten more stamps. With this capacity it is asserted that there is already sufficient low-grade ore mined and in sight to supply the mill indefinitely.

Unlike other rich mining sections this district from the peculiar occurrence of its ore bodies is saved, for some time to come at least, the outlay usually necessary for expensive steam hoisting and pumping machinery, in consequence of which its ores can be mined and treated at the minimum of cost. This wonderful mineral section is now almost wholly owned and controlled by the Sierra Grande Mining Company. At least a dozen original locations are now embraced in the three mines above mentioned as the property of this company. Outside of these there are many other rich and promising prospects which have been more or less developed during the year, but except in the case of the Sierra mines little data has been received in regard to any of them.

The bullion output of this district shows a considerable increase over that of 1882, the shipments of the higher grade ores alone being represented at something over $100,000 per month. With the completion of the mill and the additional facilities for mining and shipping ores, it may reasonably be expected that the production of 1884 will largely exceed that of the present year.

*Hillsborough district.*—This district lies north of the town of the same name, in the extreme northwestern corner of the county, and extends, including its placer deposits, from the suburbs of the town itself a distance of 8 or 10 miles to the northward. The leads discovered are principally gold bearing, carrying silver and copper in many instances. The principal mine of the district is the Bobtail, located about 2 miles north of Hillsborough, which has been actively operated during the year. The main working shaft has attained a depth of about 200 feet, and is furnished with steam hoisting works of moderate capacity. It is regularly opened by levels, drifts, &c., to the extent of about 1,000 feet, which show the vein to be a true fissure and rich throughout the development, the width being from 4 to 8 feet. It occurs in a porphyry formation. The ore is sulphuret in character and free milling, medium in grade, and said to be improving as depth is gained. Considerable stoping has been done in the 100 and 150 feet levels; at least 3,000 tons of ore have been taken from the former. There is said to be a marked difference in the grade of the ores of the two levels, those of the 150 level being much the richer, the yield running from $15 to $25 to the ton upon the plates, while the tailings contain an equal amount, much of which is saved by concentration. It is believed to average $30 to the ton, while some will run as high as $100. Between the 150-foot level and the bottom of the shaft the vein has been found to widen sufficiently to completely fill it, and the ore has improved so much as to warrant its shipment when it is found to average $60 to the ton in value. It is believed that ore of this grade will be found in sufficient quantities to pay all expenses, and milling will in consequence be temporarily discontinued, to be resumed when the company's mill can be furnished with more improved appliances for the economical treatment of the character of ore produced. The mill, an old one, belonging to the mine is a ten-stamp, with a capacity of 20 to 25 tons per day. It is furnished with three Freu vanners and a concentrator, but experience has demonstrated that still better machinery is necessary to the proper reduction and treatment of its ore. The work of development of this property has been pushed with energy during the greater portion of the year, and night and day shifts are kept constantly employed. In the 100-foot level a singular accident occurred some three or four months ago, which will entail considerable loss upon the owners of the mine. A portion of the porphyry wall on the west side became loosened by water and gave way, crushing the heavy timbers as if they were but straws, and entirely closed the drift for a considerable distance. Fortunately the accident occurred at night, when no one was in the drift, so it was not attended with any fatal results.

The Golden King is another mine belonging to the proprietors of the Hillsborough mill. It is located on the same ledge with the Bobtail, and about a half mile east of it. A shaft has been sunk to a depth of about 100 feet on the vein, which, like the one above described, is regarded as a true fissure in a porphyry formation. The vein is much narrower than that of the Bobtail, but the ore is reported to be much higher in grade. Work for the present has been discontinued on this mine, owing to the fact that the other mine of the company has been able to furnish more ore than the mill could treat.

The district contains other locations upon ledges of gold, silver, and copper, but they have not been extensively developed; in fact, aside from the operations already described, little has been done. The Oro Fino and Longstreet are both gold prospects upon which some work in the way of prospecting has been done. They are located on a ledge some 5 miles north of the Bobtail, and are said to show up very well. The ore is free milling, and is reported to yield an average of about $40 to the ton.

The production of Doña Aña County for the year 1883 was $1,225,000 in silver and $85,000 in gold.

## GRANT COUNTY.

This county is the most important producer of the precious metals in the Territory. Throughout its entire extent valuable discoveries have been made, and at this time mining operations are carried on extensively in at least thirty different localities.

The *Burro Mountain district*, lying from 10 to 18 miles south and southwest of Silver City, is the largest mineral district in the county. It embraces a territory of over 100 square miles, and contains some of the most important mining camps in New Mexico. Within its limit lie the subdistricts of Paschal, Oak Grove, and Sulphuret City. The ores of the two former are principally copper.

The first is in the vicinity of the town of Paschal, where are situated the reduction works of the Valverde Mining and Smelting Company, which owns and controls the principal mines of the district—some fourteen in all—of which nine are patented properties and three, the Saint Louis, Pittsburgh, and Boston, are in process of active development. The Saint Louis and Pittsburgh are now the leading mines in point of production. They are opened by a working shaft to a depth of about 425 feet, and by a regular system of extensive levels, drifts, cross-cuts, tunnels, and winzes. The working shaft is amply supplied with hoisting and pumping machinery. In fact, all the appliances of the company are modern and well adapted to the purposes of mining and reducing ores. The formation of the district, generally, is granite, quartzite, and porphyry and the veins or pay-streaks occur between contacts of the last two. The ore is invariably a green carbonate, but as depth is attained changes to red and black oxides. Much native copper is also found and occasionally rich sulphurets occur.

The Boston and Colwell, the latter another promising location of the district, have both been developed sufficiently to demonstrate that they are valuable claims, and the others have been opened enough to expose excellent ore bodies. What per cent. of silver the product of these mines carries is not reported.

The Lone Star is a recent location about a furlong from the Valverde Company's furnace, which is said to give promise of becoming an important mine. It has been opened by a cut in the side of the hill which revealed a fine ore body 12 feet in width, but as no hanging wall has yet been encountered, it is not known what its full width may prove to be. The ore is quartz carrying copper glance and black oxide of copper. It is said to be rich in silver and to yield about 45 per cent. in copper.

Oak Grove is the seat of the reduction plant of the Queen City Copper Company. This company owns a number of excellent mines in this district, from which a great deal of copper matte has been produced.

A Boston company also owns a large number of mines in this district, which are being developed with considerable activity.

In *Bald Mountain district* some work has been done during the year in the way of development on the California group, Sumner, and Voltaire. A shaft on the latter, in ore reaching its entire width, developed a fine ore body, which run high in lead and assayed well in silver. Some very high-grade ore has been shipped from the Sumner mine to Colorado smelters and work is still being prosecuted. Shipments from the California group have also been made, from which very encouraging returns have been received. As depth is attained the vein increases in width and retains its richness. Altogether the work done is said to prove that the mines of this district possess considerable merit.

A few miles west of Paschal is situated the *Sulphuret City district*, which contains promising locations. The formation is in all respects similar to that of the other districts above described, except that the ledge is iron-capped and the ores contain little if any copper. The work of development has been going on steadily during the year, but no details have been furnished. It is asserted, however, that with every blast the indications become better and the owners are greatly encouraged.

*Bullard's Peak district.*—In the western portion of the Burro Mountains, about 10 miles west of Paschal, lies an important district of this name, which has been the scene of active operations during the greater portion of the year. Among its most important locations is the Black Hawk, and in addition there are seven other properties, all of which are owned by the Solid Silver Mining Company. The first named is the oldest and most extensively developed mine in the district. It is opened by several shafts, and by levels and drifts at intervals of 50 feet. The main working shaft has attained a depth of about 325 feet, and is supplied with steam hoisting and pumping works of sufficient capacity to carry it down to a much greater depth. The drift of the second level has been driven a distance of over 300 feet to intersect another shaft where the erection of auxiliary hoisting works is now in progress. When this is completed it is intended to increase the force. The company is also engaged in the erection of sampling and reduction works. The pay-streak of this mine, or rather pay-streaks, as there are two well-defined fissures, are from 18 to 24 inches in width and carry ruby and native silver, which gives returns of upwards of 200 ounces to the ton. The vein occurs in a formation of porphyry and syenite between smooth and regular walls, and is said to improve and widen as depth is gained. Much ore is already on the dump, but it has been the aim of the management to uncover and let it stand in the levels and drifts until the works are in readiness to treat it. Shipments of ore from this and other mines of the company during the year have netted between $7,000 and $8,000 to the car-load.

The Horn Silver has been opened by several shafts, one to a depth of nearly 100 feet. The formation is similar to that of the Black Hawk, and the ore is also similar in character and richness. At the depth mentioned the pay-streak of the vein is about 18 inches in width. The outcroppings on the ledge, which is believed to be the same upon which the Black Hawk is located, seem to indicate that large ore bodies are hidden underneath. The mine is said to be promising.

The Silver King.—This mine has been opened by a shaft to a depth of 100 feet, and by levels and drifts to the extent of some 150 feet. Ore has been shipped from which returns of 750 ounces to the ton have been had. In the formation and character of its ore it is also very much like the Black Hawk, and bids fair to become a fine producer during the coming year. The mine is the property of Bradly & Company, of Silver City.

Marvelously rich discoveries are reported to have been made recently at a point about a mile south from the Black Hawk, but particulars have not been given. When the ledges are thoroughly prospected this will doubtless prove an unusually rich district. Much work, however, remains yet to be done.

At Mineral Springs, which is a portion of Bullard Peak district, there have been some promising locations made. The ore is a fine-grained quartz, carrying green horn, native and chloride silver. The vein or pay-streak shows from 15 to 18 inches in width. Considerable work has already been done, and the parties interested propose pushing the work of development with energy.

*Bear Mountain district.*—This is an old prospector's district, lying about 8 miles northwest of Silver City. Until recently but little development had been done, and few mineral deposits were found that were sufficiently promising to warrant expensive exploration. Within the year, however, it has assumed a new importance owing to the discovery in April of a ledge that is reported to be of marvelous richness. This discovery was made in the northwest portion of the district, in what is known as Camp Fleming. A tired prospector had seated himself upon a bowlder to rest, and whilst so resting amused himself by picking the stone in an absent-minded way, when his attention was attracted by his pick encountering a soft substance. This he removed for assay, and to his surprise it showed a value of about $18,000 to the ton in silver. A location named the Old Man was at once made, and the work of development was commenced. This is a valuable property, so far as present development will enable a correct judgment to be formed. The ledge on which this mine is located is on what is known as the Continental divide. The formation is limestone and granite. An extensive quartzite dike can be traced for a long distance. The mineral occurs in a contact of limestone and quartzite in porphyry. The ore is horn and native silver and sulphide of silver, carrying some gold. Since the discovery, the Old Man prospect has been worked with unremitting energy, and it has been developed, according to report, into a mine the low-grade ores of which alone are sufficient to keep a fifteen-stamp mill, located at Silver City, employed night and day, besides producing for shipment a great quantity of unusually high-grade ore. Whether the development has been with a view to opening up the mine systematically or simply with a view to extracting the greatest quantity of ore in the shortest space of time has not been reported. A number of shafts have, however, been sunk, some to a depth of nearly 100 feet, and tunnels, drifts, and cross-cuts have been driven into the vein. From 2,000 to 2,200 tons of ore are reported on the dump of the mine, and large quantities (some seven hundred sacks) of high-grade ore are now ready for shipment.

The Old Man mine now employs from thirty to thirty-five men constantly, and its daily output of ore ranges from 20 tons upwards. Of course it will take time and great labor to thoroughly establish the permanency of the vein or ore body thus suddenly opened up, and while the impression is generally entertained that the present development demonstrates permanency and great value, there are those who believe the paying ore will be quickly worked out.

In the immediate vicinity of the ground of the Old Man mine many locations have been made, some upon the same ledge with it, but these have as yet been simply prospected and are being held principally with a view to speculation.

The Penrose Bonanza is also said to be a wonderfully rich prospect. It adjoins the Old Man, and from appearances is located upon the same ledge. The float rock and outcroppings indicate that it will develop into a mine equally as rich as the latter, but nothing of importance has been done in the way of opening up the lead, the location being held under an option by parties who are supposed to be watching negotiations now pending for the sale of the Old Man, and postponing development with a view to favoring the purchasers. The vein of the Bonanza, as shown by a surface trench, is over 4 feet in width, and the ore is said to be so rich in places, in horn silver, as to be malleable. This property was discovered only a few days before the Old Man and by the same person.

Many other locations have been made on what is believed to be the extension of the ledge upon which this wonderfully rich development appears, but the two specially mentioned are regarded as the most valuable.

The following are a few of the other mines of the district upon which sufficient work has been done to show their value. Upon all of them rich ores have been encountered, but they are not developed sufficiently to prove the extent of the ore bodies, viz: Crowley Strike, Legal Coin, Kirby & Stone, St. Clair, Black Prince, Burro, Old Woman, and many others, upon which work is now being prosecuted, but from which no shipments of ore or data in regard to development have been reported.

Silver City, the county seat of Grant County, is the center of an important mining industry. Within 1 mile of the city limits to the southwest is what is known as *Silver Flat district*, and due west 2 miles is the *Chloride Flat district*. Both of these have been bullion producers for ten years and upwards, one mine alone having produced in the last few years in the neighborhood of $2,000,000. There are two stamp mills in active operation located at Silver City, one of ten stamps belonging to Mr. Breman, the other of fifteen belonging to the Carrollton Company; the latter, having been leased by Mr. Fleming, has been treating ore from the Old Man mine for the last two months. The mill is run night and day, and is reducing an average of about 25 tons daily.

Fifteen large wagons are hauling ore constantly from the mine at Fleming, and more will be engaged as soon as they are to be had, for the purpose of accumulating a store to keep the mill employed in case of bad weather and consequent heavy roads. The ore treated is principally of low grade, the higher grades having been assorted and shipped to Colorado smelters. Ore of the value of $40,000 is said to have been so shipped from the mine now supplying this mill.

The important mines of the camp above mentioned are the Breman or Seventy-six, Sherman, Two Ikes, Texas, Legal Tender, No Issue, Old Timer, and many others. The Seventy-six produces most of the ore operated by the ten-stamp mill referred to, and, in addition, numerons shipments of car-loads of its higher grade ore have been made to smelters outside of the county. These shipments give returns that rarely ever fall below 600 ounces to the ton, and generally run much higher. The ores shipped are usually smelting in character, and they are made principally because there is no smelter at Silver City by which they can be economically treated. In fact, the smelters located there are simply rude Mexican structures. About seventy-five hands are now employed on the various mines of the Breman group and in connection with the mill.

The Sherman is the next mine in point of importance in these districts, but from some unaccountable cause it has been permitted to lie idle during the greater portion of the year. This mine has been actively worked in the past and has been an extensive producer of a fine quality of ore. Since the resumption of operations some fine and large ore bodies have been uncovered, and its dump shows a considerable quantity of ore that is reported to average over $200 to the ton without assorting, and the output is said to be at the rate of 10 tons a day.

The Grand Central mine, an extension of the Sherman, is being developed, with fine prospects of striking the same vein that is yielding so well in the latter. As yet it is but a location.

Adjoining the Seventy-six are four claims owned by the New York and New Mexico Mining Company. The Hidden Treasure is the principal of these. A shaft has been sunk upon this location to a depth of 100 feet, and hoisting works are now being erected with a view to continuing the work. No other data as to development, character of ore, size of vein, &c., of this group of mines has been received.

The Thicket mine is located about 2 miles north of the Seventy-six. It is opened by a shaft to a depth of about 100 feet. The formation and contact are similar to that of the Seventy-six. The ore is carbonate in character, and runs very high, assays from $25 to $800 to the ton being reported; there are said to be some 300 tons of first-class ore now on the dumps of this mine, which is a good showing for the development made.

Some 2 miles west of Chloride Flats, near the Fleming road, a new discovery is reported. It is called the Hancock. Assays from the surface rock give from 78 to 400 ounces of silver. Th amount of development work done has not been reported, but the prospect is regarded as a very valuable one.

Silver City is properly entitled to prominence as the mining center of the Territory, as, aside from the placer workings at Pinos Altos, it is the oldest mining district. It was here that the first silver ores were mined and the first modern works erected for their reduction, and that, too, at a time when the necessary machinery had to be transported overland from Saint Louis, a distance of about 1,500 miles. Until this was accomplished the ore produced was treated in the rude manner common to isolated mining sections, *i. e.*, by the cold-air blast smelting process, which usually resulted in a percentage of loss in volatile ores equal to nearly half of the mineral contained, but even with this great waste enough of the precious metal was saved to support the hardy miners and enable them to accumulate sufficient capital to meet the enormous expense incurred in the erection of its first mill. Other mills succeeded this as new mines were discovered and developed, and a few adobe smelters, slight improvements upon the original, were also built, but no really first-class works have so far been built. It is now the intention to erect a plant that will be equal to the demands of this most important mineral section. To this end works, including a first-class water-jacket smelter, containing all the latest and most approved improvements, will likely be erected during the coming summer at a cost of some $200,000. A branch of the Atchison, Topeka and Santa Fé Railroad has been extended from Deming to this place, so that it now has the advantage of rapid communication with the outside world. After a long and heroic struggle with causes that have not only retarded its growth, but at times had almost paralyzed its enterprise, prosperity has at last dawned and assured success has lighted up the camp with promises of a brilliant future.

*Pinos Altos district.*—This district has been a producer of gold bullion for nearly twenty-five years. It was originally worked as placer diggings, and is represented to have been exceedingly productive. In certain localities the gravel is still being washed, principally by Mexicans, who are reported to make good wages, but the scarcity of water in the vicinity of the deposit beds makes the labor exceedingly slow and irksome, and it is in consequence only during the rainy season that it is really profitable. The mountains of this district have been very thoroughly prospected for mineral ledges, and many important discoveries and locations have been the result. Many of these have been profitably worked for years past, but the want of improved machinery to treat the ores which were found to become refractory as the water level was approached caused a suspension of work on most of them. The leads of the district have the appearance of true fissures, and they generally occur in a micaceous granite formation. The ore produced is a free milling quartz to a depth of from 50 to 75 feet, when it changes to iron and copper pyrites, which cannot be treated except by the smelting process. The district also contains ledges of carbonates and galena ores, carrying in some instances a heavy percentage of silver.

The Pacific Nos. 1 and 2, Atlantic, Aztec, Arizona Nos. 1 and 2, Lamiena Grande are a few of the old and valuable developments of the district. Considerable work has been done on all these, as well as others not named, but especially upon the Atlantic and Pacific No. 2; in the latter an important find or strike of very rich native wire gold is reported. A few specimens showed more than half pure gold. The entire pocket, of some 15 tons or more, is said to run well up in the hundreds.

The work on the Atlantic is being pushed with considerable vigor, the main shaft having attained a depth of upwards of 150 feet. In the bottom of this shaft the ore body is said to be 3 feet wide, which width it has maintained for the last 50 or 60 feet, and gives assays of from $15 to $100 in gold, and from 5 to 30 ounces in silver to the ton. There are reported to be from 200 to 300 tons of ore of this character on the dump of the Atlantic.

Of the newer mines of the district the Alpha and Omega is the most promising, and, from the reports given, it bids fair to rival any in the district. The ore body has been uncovered by a cut over 150 feet in length. The surface has been stripped for a depth of about 65 feet from this cut by 100 feet in length, exposing an enormous body of ore, of which actual mill tests have given from $23 to $30 per ton in silver. The owners of this mine have contracted to furnish the Socorro smelter 1,000 tons of this ore, and two car loads are being shipped daily in fulfillment of the same. The mine employs from twelve to fifteen men at the present time. The ore of this mine, as shown by its present development, is a lead carbonate. Some underground work has been done to demonstrate the extent of this enormous deposit, and the results are reported to be satisfactory.

The Alice and Carrie are also two new discoveries on the west slope of the Pinos Altos Mountain. A shaft 50 feet in depth, along a smooth porphyry wall, has been sunk on the former, and shows a fine vein of lead carbonates, similar to the one of the Alpha and Omega, and of about the same value.

The ledge of the Carrie runs parallel with that of the Alice, and the claims adjoin. A 20-foot development shaft has been sunk upon it, but the character of the ore encountered is not reported. The ground is said to be remarkable for its large iron outcroppings. These lead carbonate ores, in addition to the value of the silver which they contain, are worth almost, if not quite, as much more as a flux, or at least will be if the smelter under contemplation is built at Silver City during the coming summer. The distance, by good roads, is only about 8 miles.

*Steeple Rock district.*—This is another gold-bearing district, lying in the Gila Mountains, in the northwestern portion of the county, about 45 miles from Silver City. Perhaps no portion of the county has been the source of more active mining operations than has been displayed in the development of this district during the year 1883. Work has been vigorously prosecuted on the old mines, and new discoveries have been made and developed into promising properties.

The general formation of the district is porphyry, and the veins, which are usually true fissures, occur in quartzite ledges of enormous width, as shown by the bold outcroppings.

The principal mines of the district are the Carlisle, Pilgrim, Gold Note, Diamond, Advance, Nugget, Turk, Rain-in-the-face, Little Emily, Pennsylvania, and Mitchell.

Of these the Carlisle is the most extensively and systematically developed. The main shaft has attained a depth of over 340 feet. This is a triple compartment, two for buckets and one for pumping. It is furnished with steam hoisting and pumping works. There are four additional shafts on this property—one an incline on the vein, sunk to a depth of 120 feet; another has reached a depth of about 175 feet; still another is down 100 feet; and between the two last another has been commenced, which is about 50 feet in depth. In all of them good ore has been found, but it is reported to be best in the main shaft. One of these shafts is to be furnished with additional steam hoisting works. The levels and drifts which have been run are principally in ore that is said to average $75 to the ton without assorting, $40 of which is in gold. The mine is supplied with a twenty-stamp mill, but, owing to a scarcity of water, the entire capacity of the mill has not been utilized during the year. Much of the time only from five to ten stamps have been in motion. At the bottom of the main shaft, however, sufficient water has been struck to supply a mill of forty stamps; so this most serious obstacle will no longer interfere with its operations. The ore which the mill has treated during the year was obtained from an open cut on the ledge of 14 feet in width, at a point where the vein measures 30 feet wide, all believed to be pay ore. This cut has been extended about 175 feet, and it is said that ten men can readily remove sufficient ore to keep a twenty-stamp mill employed day and night in its reduction. The ore from the shafts is much higher grade than that produced from this cut, and it is said to improve in value as greater depth is gained, becoming sulphuret in character near and below the water level. About fifty men are kept constantly employed by the company. Some 300 tons of concentrations are on hand, and many tons of ore are on the various dumps, besides thousands of tons said to be in sight.

The Pilgrim is on the same ledge with the Carlisle. Work in this mine has been greatly retarded by a great volume of water encountered in its principal shaft, and which cannot be removed by reason of the want of necessary pumping machinery which the owners have not the capital to supply at the present time. Eventually what is now a hindrance to development and extremely vexatious, will prove advantageous and valuable, because the water will be needed when the work is carried on more extensively. The ore is similar to that of the Carlisle, and has been found in large bodies.

The Gold Note is another promising mine, lying to the eastward of the Carlisle. The development is not extensive, but some good ore has been produced by it and a recent rich strike is reported.

On the Diamond mine the main shaft has reached a depth of about 100 feet on a good 4½-foot vein; a cross-cut has also been driven through to the north ledge, a distance of 120 feet, where a vein of equal strength was found. The ore of this mine is both gold and silver bearing, some of it being exceedingly rich in the former, assays as high as $5,000 being reported.

The Advance mine is located on a ledge about a half mile north of the latter, and is said to be very promising. A shaft something over 50 feet in depth has been sunk, and a cross-cut from wall to wall has been run, showing the vein of decomposed quartz to be 16 feet in width. Assays of this vein matter at 16 and 35 feet in depth gave returns $41 gold and 3 ounces silver, and at the greater depth $150 gold and 4 ounces silver.

The Nugget is on the same ledge with the Diamond, but the vein shows up 7 feet in width and carries considerable free gold. The main shaft is down 125 feet, from which point a cross-cut is being run to cut the north ledge, as in the Diamond. The east shaft has attained a depth of about 100 feet through good paying ore the entire distance. At the depth of 100 feet a drift will be run to intersect the main shaft. The ore thus far produced is said to be worth $100 to the ton, principally in gold. Night and day shifts of hands are being worked in both shafts of this mine, as well as upon other development work on a ledge some 20 feet north of the ledge upon which the main shafts are sunk.

The Great Eastern is an adjoining claim, upon which but little more than assessment work has as yet been done.

The Little Emily is developed by a shaft upwards of 50 feet deep, and shows a vein of ore 4 feet thick, which is said to average $100 clear across. West of the shaft, for a distance of about 150 feet, the surface of the vein has been uncovered or stripped, and it shows 12 feet of mineral similar to that at the bottom of the shaft.

Rain-in-the-face has been opened by two shafts, one of 100 feet, the other 50 feet in depth, in ore almost the entire distance that gives assays clear across the vein that average $75 in silver and $16 in gold. Some 250 or 300 tons of ore of this grade is now reported on the dump of this mine, all of which was obtained from the shafts mentioned and about 60 feet of drifting on the vein. This is regarded as one of the best locations in East Camp.

The Turk mine is looked upon as the most remarkable of any location on the ledge as to the extent of its ore body and richness in free gold. Like the Carlisle, the bulk of the mineral contained is gold, and in such quantity that color can be readily obtained from dirt taken from any portion of its dump. The property has been opened by two shafts, the deepest of which is down 65 feet; the other is 38 feet in depth. In addition some 65 feet of drifts have been run. These excavations are said to be entirely in ore, and a cross-cut between walls at the bottom of the main shaft shows the vein to be of the enormous width of 28½ feet.

The Mitchell is being actively developed at the present time by two shifts of hands, the main shaft being down something over 110 feet. A second shaft has attained a depth of about 40 feet. Water in considerable volume was encountered in the main shaft at the depth mentioned, which compelled a suspension of the work of sinking. A platform was consequently erected and a drift on the vein commenced. There is said to be about 150 tons of ore on the dump that will run about $70 to the ton, in silver principally.

The Norman is another promising location lying some 3 miles to the northeast of the Carlisle. The ledge upon which the shaft is being sunk is reported to be 125 feet in width. The shaft is about 80 feet deep—the entire distance in ore that is said to average so well as to render assorting wholly unnecessary. Assays show this ore to be worth $100 to the ton in silver and gold, the former slightly predominating.

The Pennsylvania is the first extension east of the Carlisle, and is believed to be a good property. No development other than assessment work has yet been done. Quite a number of persons are interested in this property, few of whom can afford the expense of developing, in consequence of which the property has been permitted to lie idle until the present time.

Considerable work has been done on the Eagle, an old location of the district during the year. A shaft 125 feet in depth has been sunk on the contact, and a contract for 75 feet of drifting and cross-cutting is now in process of execution. When this is completed the extent of development will aggregate about 325 feet. The mine is said to be very promising.

There are many other rich and promising locations in this district that have been more or less developed, but it is impossible to enumerate all of them. *Steeple Rock district* bids fair to take high rank as a bullion producer during the coming year. In the character of its ore it is said to resemble the celebrated Comstock lode.

*Telegraph district.*—This mining district, lying on the Gila River, about 30 miles almost due west of Silver City, has been the scene of quite active operations during the year.

The Mother Lode, Tecumseh, Avery, Iroquois, Good Hope, and Laura Emma are the principal mines. Most of these are owned by the Telegraph Mountain and Gila River Mining Company, who propose erecting a twenty-five-stamp mill at an early day for the reduction of their ores. The Mother Lode is the best developed. An incline shaft has been sunk on the vein to a depth of 275 feet, and it is opened by levels at regular intervals, all of which show a compact vein about 5½ feet thick. The ore is high grade, composed principally of sulphide and chloride of silver in a quartz gangue between porphyry and granite walls. Many hundreds of tons are now on the dump, which after assorting will, it is said, give mill runs of 40 ounces to the ton, the higher grades running about 250 ounces. The ore is reported to be unusually free milling, and can be mined at the minimum of cost. The expense of transportation also will be only nominal, owing to the situation of the mine. It is, therefore, claimed that the lower grade ores that could not be worked anywhere else can be treated profitably.

The Tecumseh is opened by an adit and tunnel to a depth of 110 feet, and shows a vein from 5½ to 6 feet which has been stripped on the surface for a distance of about 120 feet. Its ore is said to be of high grade, equal to that of any other mine in the district. The stripping shows the vein to run evenly, and it is claimed that it would be difficult to find a stronger or richer ore body anywhere in the Territory. The adit has been enlarged and fitted for tramways and cars.

The Good Hope is another promising mine in the vicinity of the Mother Lode. It is opened by an incline on the contact to a considerable depth. The vein is said to be 6 feet thick; the ore is free milling, but of low grade, being rated at 30 ounces to the ton. A vertical shaft is being sunk in the granite contact with a view to cutting the same body of ore that is being found in the Mother Lode, and it is expected to reach the vein at a depth of from 60 to 75 feet. The work of development is being pushed with energy, and night and day shifts of hands are employed.

The Avery has been opened by a shaft to a depth of 70 feet and by a lateral drift to the south to the extent of some 50 feet more. This is considered a true fissure vein between perpendicular walls, and is said to be unusually rich in horn silver and black sulphurets.

The Laura Emma lode has been developed by a shaft to a depth of about 50 feet. This mine also belongs to the same company, and the development was made to aid in determining the character and size of works to be erected.

Late in the year a strike was reported of a fine and rich body of ore on the Iroquois mine, which adjoins the Good Hope on the southwest, and the ore body was found close to the dividing line between the two claims. The ore is a rich chloride, and occurs in deposit form in sandstone. This encouraging discovery is regarded as of great value, because it proves the extent and continuity of the ore body underlying Telegraph Hill; but to demonstrate this beyond a doubt will require time and much labor.

There are many other promising locations in this district upon which the development necessary to cover the assessment work only has been done, which, upon completion of the mill, will most likely be more thoroughly opened. Experience, however, shows that prospects at first most promising do not always prove the most profitable producers in the end.

Several car-loads of ore have been transported from the mines of the district during the year, from which returns of about $300 to the ton are said to have been received. Aside from this there was no output of bullion reported from the district for the year 1883.

In the *Carroll district*, about 3 miles southwest of Telegraph Hill, a strike was recently made in the Ednor mine. The shaft of this mine is down some 40 feet, and the ore is represented to fill the entire extent of the shaft, and is said to be rich in native or wire silver. This claim is one of a group upon which little more than assessment work has hitherto been done.

*Cow Springs district.*—Some activity has been displayed during the year in opening up the mines of this district; but with one exception no unusual discoveries have been reported.

In the Arthur Lee mine a 40-foot ledge of lead carbonate was uncovered for a distance of 12 feet. Average assays show that the ore runs about $55 in silver and yields a high per cent. in lead. Sample assays of specimens are said to have given fabulous returns. This mine is located in what is known as Given's Camp, about 3 miles southwest of the Marble Hill group of mines, in the same district. The deposits of this district lie near the surface of the ground; the ore can, in consequence, be mined at little cost. Cow Springs is in the foot-hills of the southeast end of the Burro range of mountains. Aside from the one mentioned, the following are the principal developments of the different groups or camps, viz: Horn Silver, Silver Bullion, Lost Mine, Silver Fox, Crown Point, Eighty, Uncle Sam, Peg Leg, Osceola, and Iron Crown. No particulars as to work done on these locations, or amount of ore produced from them during the year, have been received.

*Lone Mountain district* lies about 8 miles southeast of Silver City. There are some good prospects in the district, but the work of development has not been pushed energetically. The formation is limestone, and the veins are said to be small generally, but bear a high grade of ore. The principal work done was on the Bisby group of mines, but the production was not large. The mines composing this group are the Monarch, Virginia, Little George, and Allen.

The shaft of the Home Ticket has attained a depth of upwards of 75 feet, on a vein which is said to produce ore that yields from 200 to 300 ounces of silver to the ton. Though regarded as one of the best mines of the district, it has been but slightly worked.

The Walter mine is opened by a shaft to a depth of 40 feet, which shows a 3-foot vein that produces ore assaying as high as 400 ounces in silver to the ton.

The Pencate has a shaft 30 feet deep on a vein that measures 7 feet in width, with a 3-foot pay-streak.

The shaft of the Mother Lode is 75 feet deep on a well-defined vein of sulphurets and native sheet copper.

The main shaft of the Maud S. is down 40 feet on a vein 4 feet wide which carries a 22-inch pay-streak of low-grade silver ore. The vein is said to be well defined with smooth walls.

The Silver Cord is developed by a shaft to a depth of 10 feet, showing a good vein and pay-streak 28 inches in width, which is reported to run well in both silver and lead. This district is without reduction works, although in the past it has been a considerable producer. The veins are small and irregular, but the prospects certainly seem to warrant more systematic exploration than has been reported.

The Victoria, Eva, Sublime, Wabousa, Antioch, Star, Plutus, and Plata Verde are some of the other developed properties of the district.

*Central City district.*—This district lies some 4 miles north of Lone Mountain, and 9 miles nearly due east of Silver City. It is a large and important district, including within its limits a gold belt, as well as silver. It embraces the subdistricts of Copper Flats, San José, Ivanhoe, and Hanover Gulch. In the first of these but little development during the year has been reported, the later and richer discoveries elsewhere having attracted the capital and labor from these districts.

The *San José* is more properly a copper-producing district, but the ores of its mines are said to carry a considerable quantity of silver, in some instances running 25 ounces and upwards to the ton. A 30-ton smelter has been erected at San José during the year, of which the firm of Pope, Cole & Co., copper refiners of Baltimore, are the principal owners.

A short distance northeast of San José is the mining camp of Santa Rita, where there is also a fine plant for the reduction of its ores. The mines in the immediate vicinity are well and extensively developed and have been enormous producers, but what proportion, if any, of silver is carried by its ores has not been reported.

The Ivanhoe camp lies about 1 mile north of San José. Its principal mine is the Ivanhoe, from which the subdistrict takes its name. This mine is developed by a working shaft to a depth of about 160 feet, and by a discovery shaft 50 feet in depth; in addition, it is opened by drifts on the vein of over 100 feet in each direction, that to the southward being near 150 feet in length, which show it to be 6 feet in width. The ore is a sulphide, and rich in silver, copper, and lead, the proportions being about 100 ounces silver, 13 per cent. copper, and 40 per cent. lead to the ton. Fifteen men are constantly employed, and a vast quantity of ore is on its dump. Early in November last the smelter erected to treat the ores of this mine was put in blast, and it was believed that enough ore had then been mined to keep it supplied throughout the winter. Considerable quantities of the ore of the Ivanhoe are also sent to the smelter at Deming to fill an old contract. From some cause the Deming smelter is believed to be able to reduce the ore to better advantage than the company's smelter. The mine is reported to be looking splendidly, and is, with the force employed, producing from 10 to 20 tons of ore per day.

The erection of a five-stamp gold mill to treat the ores of the Clyde and Mayflower, two locations a few miles west of the Ivanhoe is contemplated. It will be built on San José Creek, at the second crossing east of Fort Bayard, and in close proximity to the mines, the ores of which, it is believed, will keep it constantly employed.

*Hanover Gulch district* lies north of Santa Rita and Ivanhoe. Considerable activity has been displayed in the development of its resources during the year. Among the new developments are the Silver Crown, Guyanadon, and Mother Lode.

The Silver Crown has been worked for a number of years, but its main ledge was not discovered until some time in December of this year. The vein as uncovered shows an ore body fully 9 feet in width, the character of which is lead carbonate carrying large quantities of silver. Numerous assays give an average of 55 per cent. lead and from 50 to 300 ounces of silver. The mine is only about a mile north of the Ivanhoe smelter, where the ore is likely to find a ready sale, owing to the great percentage of lead it carries, which will be useful in the reduction of refractory ores. The extent of work done upon this mine is not reported.

The Guyanadon mine, near Hanover, passed into the hands of a Chicago company early in the year. The ledge is said to show a wonderful deposit of mineral, it being represented to be from 25 to 30 feet in width, and to give average assays of $25 to the ton in silver and about 10 per cent. in copper.

Mother Lode mine has been opened by a shaft to a depth of over 70 feet, and by a drift on the vein, which is said to show a solid body of ore that gives assays of from 25 to 30 per cent. in copper.

The Maud S. mine and group, sometimes known as the Humboldt Mountain mines, have been somewhat developed. The development had been retarded by litigation, but early in the year a settlement was reached, and the properties passed into the hands of Eastern capitalists. This mine has been worked to a considerable extent, and 90 tons of ore milled gave the following returns: 25 ounces silver, $6 in gold, and an average of 17 per cent. in lead to the ton. The ore appears in chambers in a lime formation, and it is claimed that the workings show from 10,000 to 15,000 tons in sight.

Upon the following mines of this district, considerable work is reported to have been done in the way of sinking shafts, driving tunnels, &c.: The Monmouth group, Jim Fair group, Hutchinson, Mackay, Last Chance, Eighty-one, Avalanche, Iron Mountain, Contention, Reliance, Sirius, Sleeping Pet, San Domingo, Homestake, Sorrel Top, Sophia, Santiago, Henriques, Topaz, Willis, Iron Head, Iron King, Hornet, Jim Taylor, Albion, Emperor William group, Philadelphia group, &c.

*Georgetown district.*—This is one of the best and most systematically developed mining districts of Grant County. The best mines are within the town limits; in fact it may be said that the village of Georgetown is built in the very center of the mineral belt. Georgetown lies about 23 miles northeast of Silver City, in the foot-hills of the southern terminus of the Mimbres range of mountains. Aside from reported rich strikes in the McGregor and Naiad Queen mines, there has been but little in the way of excitement in this very prosperous mining community. It must not be understood that the industry has not been vigorously and energetically pushed, or that the mines are less prolific in their output than formerly. This is not the case, as may be judged by the yield of the mill located on the Mimbres River, some 4 miles distant (where the ores produced are generally milled), which is reported to be within a fraction of $250,000 in value. In addition to this, a considerable quantity of high-grade ore has been shipped to other points for treatment. The mill has been closed for a few months pending negotiations with an English syndicate for the purchase not only of the company's plant, but all of the mines owned by it and some of the other principal mines of the district. As an evidence of the value of the district, small as it is in size, it may be remarked that the amount involved in this negotiation aggregates about $1,000,000.

The strike or discovery in the McGregor mine referred to was made in the latter part of June last, and consists of a huge deposit which has been penetrated by a drift 10 by 12 feet in dimensions for a considerable distance, showing the ore to appear in an unbroken body on both sides and on top. Much of this ore is high grade, that is running to 150 ounces to the ton, and it is believed that the mass will average 70 ounces silver to the ton. The quantity now in sight is said to be upward of 200 tons, and how far the deposit extends laterally, or its depth in the face of the drift, must of course remain a matter of conjecture until labor finally develops it. Night and day shifts of hands are being worked, and the quantity of ore produced daily is about 25 tons. Ordinarily the capacity of the mine was about 15 tons, and it is now estimated that it can be made to produce a sufficient quantity to keep a twenty-stamp mill regularly employed.

The dumps of the mines about Georgetown still show many thousands of tons of low-grade ore, of, say, 50 ounces and less to the ton, which will largely increase the bullion product of the district when better milling facilities are afforded. The mill on the Mimbres being 4 miles distant, the ores transported there are usually assorted to run 50 ounces and upward, as a lower grade than this will not pay the milling expenses in addition to the cost of hauling it so great a distance.

In the Naiad Queen, upon which much work was done during the year, some very promising deposits of ore were also uncovered. These were found outside the vein proper in the limestone country rock. In some instances they were quite extensive, and the ore was found to be of high grade.

The *Kingston* or *Percha district.*—This district is in the northeastern portion of the county, about 12 miles west of Hillsborough. The town of Kingston, situated on the Middle Percha, almost in the center of this mineral belt, is a thriving village, which owes its growth to the rich discoveries made in the vicinity and the energetic development of the mines. The district embraces three distinct camps, viz, North, Middle, and South Percha, in each of which some very rich mines have been opened.

In the vicinity of Kingston are the Superior, Bullion, Lady Franklin, Iron King, Caledonia, Savage, and many others. Of these the Superior is the most extensively developed. It has seven shafts and inclines, one of which, the main working shaft, has attained a depth of about 300 feet, and is thoroughly timbered with 8-inch square timbers throughout the entire depth. Up to the present time the hoisting has been done by a horse whim, but it is intended to furnish the mine with improved hoisting and pumping works at an early day. At a depth of 200 feet a level has been opened on the contact to a distance of over 225 feet. For most of the distance this level is in good ore, and in places large ore bodies are exposed, some of which have been prospected from 10 to 30 feet from the contact, showing the deposits to be quite extensive. From some of these considerable quantities of ore have been extracted for shipment, but not to any great extent, as the work was done for development especially, and the shipments were usually of ore encountered in the drifts. South of the working shaft the level has been driven about 60 feet, at which point water was encountered, which interfered with its further extension. A cross-cut of 20 feet at this point disclosed some rich seams of ore, which are now being followed. Work in the Bullion mine, which adjoins the Superior on the south, is now being prosecuted with a view to opening communication between them for the purpose of securing better ventilation. Another level will be run from the shaft at a depth of 300 feet, and if the ore body continues to show at that depth as above, the owners will make necessary arrangements to continue the work to a greater depth. Some 250 tons of high-grade ore have already been shipped from this mine, and it is now being mined and hoisted faster than five ore-sorters can handle it, and about 1,000 tons of unassorted ore remains on the dump.

The Bullion mine is located upon the same ledge as the Superior, being a southern extension of it, and is the next in point of development. The workings of this mine have attained a depth of about 200 feet. An old ore chimney, to a depth of about 70 feet, is used as the main working shaft. From the bottom of this the shaft is continued to a farther depth of 20 feet, from which point a drift has been run to the contact, which, as in the Superior, is lime and porphyry, a distance of about 160 feet. No mineral was found at the point where the drift entered the contact, but in close proximity ore seams were found which led to extensive and rich ore bodies. These seams sometimes almost entirely disappear, then enlarge to 3 or 4 feet in width, and again open out into a large body, the excavation of which forms a large chamber. A winze has been sunk on the contact to a depth of about 75 feet, where a second level has been established, the south drift of which has been run on the contact upwards of 275 feet, showing occasional seams of ore, which are believed to lead to the ore vein which is being followed in the level above. At the farthest point reached, ore was encountered for the first time in the entire distance, and from the character of the surrounding rock it was regarded as the beginning of a large ore body. A drift has been run from the station to the north, a distance of 30 feet, with a view to reaching the workings of the Superior. This mine is said to look unusually well, and a new incline shaft will be sunk from the surface to connect with the winze, which will be a double compartment and fitted with improved hoisting works. The ore from this mine, is reported to be very high grade. Returns from fifteen car loads shipped to Denver are said to have aggregated nearly $50,000, an average of over $300 to the ton. In addition to this, there are now hundreds of tons of lower grade ore on the dump of the mine that await the erection of reduction works at Kingston. The production of the year is estimated at $100,000, out of which $15,000 have been paid as dividends. From 15 to 30 men are kept constantly employed in its various workings.

The Iron King mine lies about a mile to the northwest of the Superior. The ledge upon which it is located is marked by unusually bold out-croppings. The developments consist of some half dozen shafts, varying from 25 to 110 feet in depth, and by drifts and cross-cuts to the extent of nearly 400 feet. The vein is 18 feet wide on the surface and fully 30 at a depth of 35 feet, the matter being manganese and iron, containing seams of carbonate of lead of high percentage and carrying considerable silver; in fact, the deposit seems to be a vast bed of carbonate, not of high grade, but valuable on account of its adaptability for smelting purposes. As depth is gained, the vein is reported to improve. A new smelter, for the erection of which arrangements have already been made by the company owning this mine, will, without doubt, be built by the end of the year. Eighteen men are employed upon the mine, and ore is being taken out in large quantities in anticipation of the early completion of the reduction works, which include a 70-ton smelter, similar to those in use at Leadville. The works are intended to be of sufficient capacity to run three of these. Late reports show that the excavations and foundations have already been almost completed, and two hundred thousand bricks have been contracted for to complete the necessary buildings.

The Lady Franklin is a short distance from the Superior. Its development is a 110-foot incline shaft sunk on the contact. At a depth of 85 feet ore similar to that of the Bullion and Superior was struck, and was found to continue to the bottom of the shaft and in 20 feet of drift run from it. The vein varies in width from 10 inches to 3 feet, the richer ores being found in the narrower portions. About 10 tons of high-grade ore are sacked and awaiting shipment, which is estimated to be worth $700 to the ton.

The Illinois, Brush-heap, Andy Johnson, Blackeyed Susan, United States, Uncle Ned, Fairview, Polar Star, and Miner's Dream are all promising locations of the Middle Percha, upon which no extensive prospecting has yet been done.

The formation of the district is lime, porphyry, slate, and sandstone, and the ore generally occurs between walls of lime and porphyry.

The Monaska, in the South Percha Camp, is a promising and extensively developed mine. It lies nearly due south of Kingston and about 3 miles distant. It is opened by an incline shaft to a depth of nearly 250 feet, on a vein which is reported to measure 16 feet from wall to wall. The ore is free milling in character, and is said to give average assays of 236 ounces of silver to the ton, and specimens have gone as high as $18,000. The vein is in a formation of limestone, dipping towards the contact, and when this is reached it is believed that a large body of ore will be found. Four levels have been opened upon the vein, and as far as drifting has gone, all show good ore. The working shaft of the Monaska is furnished with steam hoisting works, a good shaft house and ore house, but as no pumping facilities have yet been secured, the work of development has been somewhat impeded by water in the lower workings. Twenty-four men are generally employed in the various workings of this mine. Some ore has already been shipped, and much more is sacked ready for shipment, and in addition there is a large quantity of ore on the dump of the mine. Mill returns from the ore shipped are reported to be from $3,000 to $10,000 per carload.

The Gray Eagle is the next mine in point of importance in this portion of the district, but, unfortunately, it has been idle, owing to litigation, for some time. The development consists of a tunnel some 80 feet in length on a vein about 7 feet in width. The ore, which carries silver, copper, and lead, is not claimed to be high grade, but the immense body and the ease with which it can be mined cause the mine to be regarded as one of the best properties in the district. A good wagon road has been made between this camp and Kingston, to which point its ore will naturally be carried for reduction as soon as necessary works are erected.

The Seven-Twenty and Traitor both belong to the same company which owns the Monaska, but no work other than necessary assessment has been done upon them.

The Keystone is another mine of this camp that is regarded as a promising property. A shaft upwards of 20 feet in depth has been sunk upon it, showing a vein 5 feet in width, which is said to assay high in silver.

In the North Percha camp, about 3 miles distant from Kingston, are the Solitaire, Brilliant, Keystone, Coldwater, Hillsborough, Eclipse, Chapeau, and many other locations upon which more or less work has been done, but with the exception of a few, no systematic prospecting has been made.

The Solitaire is doubtless the most valuable of these, but the work of development has been greatly retarded, owing to legal troubles resulting from a double location, the one covering or overlapping the other. Some desultory work has, however, been done, first by one of the parties, again by the other, but not with a view to scientifically and practically developing the property. Considerable fine high-grade ore has been shipped fromt he Solitaire, but what returns were obtained or the quantity so shipped is kept secret.

The Brilliant is also considered a valuable mine, and has been developed quite extensively, producing ore of exceedingly high grade, but owing to some unexplained cause it has lain idle nearly, if not the entire year.

The Keystone and Caledonia are two promising locations on the North Percha proper, upon which considerable work (the details of which have not been reported) has been done during the year. It is said the development of the year has proven this particular portion of the district to be much richer than was anticipated. In one of the workings a rich strike of ruby silver, found in a contact between syenite and trachyte, has been reported. No details have been received.

The Hillsborough mine.—Work on this property is being energetically pushed. The vein is reported to be of unusual size, and the ores produced of very high grade. The mine is being worked under bond by San Francisco parties, doubtless the same who were reported to have consummated a purchase of it last year.

Kingston is 40 miles from Nutt Station, on the Atchison, Topeka and Santa Fé Railroad, its nearest shipping point, with which it is connected by a good wagon road. From present indications this will prove an important mining section when the railroad is finally completed to Hillsborough, and perhaps extended to Kingston, which lies in the foot-hills of the southeastern portion of the Black Range, at an elevation of about 6,000 feet.

*Cook's Peak district* lies in the eastern edge of the county, a few miles distant from the military reservation of Fort Cummings. Very brief reports have been received from this district, and no details of development. Incidentally, however, I learn that prospecting is still pursued with considerable enthusiasm, and that at least some of the mines are being worked energetically, prominent among these the Montezuma and Graphic. The ore of the Montezuma is a rich galena, carrying from 10 to 12 ounces of silver as a rule, though streaks or pockets are sometimes encountered where it runs much higher. The ore is said to average about 40 per cent. lead, and is very valuable for fluxing purposes in addition to the intrinsic value of the lead and silver it contains. Teams are almost constantly engaged hauling this ore to the smelter at San José, and the southwestern smelter on the Ivanhoe property; and the owners of the mine have also a contract to furnish the smelter at Benson, Ariz., with all the ore upon its dumps. Recent development shows that as depth is gained, the ore becomes considerably richer in both silver and lead. The cost of mining and putting upon the dump it is claimed will not exceed 50 cents to the ton. From 15 to 20 tons per day are now being taken out of this mine.

The Graphic mine is showing up very promisingly from the year's development, and from a producer of low-grade silver ore suddenly takes rank for first-class ores. The strike was made in October last, and returns from a car-load shipped netted the owners $102.75 to the ton.

This district is still considered a good field for the prospector, as it has by no means as yet been thoroughly gone over, which is proven by some rich discoveries made in the latter portion of the year. The district is represented by many more mines and locations, but, as before remarked, details of development or production have not been received.

*Victoria district* lies 3 miles south of Gage Station, on the Southern Pacific Railroad. This mineral belt was discovered some three years ago, and quite a number of the locations at the time and soon afterwards made were developed to a considerable extent, some, indeed, extensively, but from some cause inexplicable, with a single exception, all have been idle during the year, or have had so little in the way of work done upon them as to make it unworthy of mention. The exception noted is the Chance mine, owned by San Francisco parties, the ore of which occurs in a system of pockets in a limestone formation. Two of these channels are said to have been found on the ground of this mine extending from near the surface to a considerable depth.

The Chance is opened by shaft to a depth of upwards of 200 feet and by several levels, the first of which is at a depth of 120 feet from the surface, which run in a northerly and southerly direction, following the trend of the vein. The extent of this first level aggregates some 600 or 700 feet, inclusive of drifts and cross-cuts, and good ore bodies are said to be exposed in both directions from the shaft and in both ore channels. The ore is lead carbonate in character, and carries both gold and silver, and averages about $40 in value to the ton. The mine is furnished with an excellent shaft-house and improved hoisting machinery, and produces daily about 25 tons of ore. The daily shipments to the Benson smelter are reported to be about equal to the quantity raised. From twenty to twenty-five men are employed by the company.

The Chance Company also own the Rover and Jackson, adjoining the Chance ground on either side, and it is said that the former will be shortly developed. The work already done shows the vein and ore to be similar in character to that of the Chance, and it is believed that it will develop into equally as prolific a producer when thoroughly opened up.

*Pyramid district.*—This district lies about 9 miles south of Lordsburg, on the Southern Pacific Railroad. Mineral was first discovered here some three years ago, since which time considerable development has been made upon many of the locations. The Viola and Last Chance are the most important of these.

The Viola is opened by shaft to a depth of over 300 feet, and by four levels upon the vein, which has been found to vary from 3 to 12 feet in width and to occur irregularly in deposits and stringers. The development appears to have been carried on in the first place with a view simply to extracting the greatest quantity of ore rather than the systematic opening of the workings. Where the stringers tended into the country rock they were invariably left without prospecting to demonstrate whether they led to other ore bodies, which is known to be of frequent occurrence in all irregular deposits. A new management, it it is said, composed of practical men, commenced operations about the 1st of October, proceeding regularly and systematically to exploit the levels, &c. The mill of the Pyramid Company, a twenty-stamp ore-crushing battery, which has been idle for so long a time, was to be put in order for active work at once. At the time mentioned 200 tons of good clean ore was ready for treatment, and the dump was reported to contain about 2,000 tons more, that could with some labor be assorted to a value of about $80 to the ton in silver. The mine is furnished with improved hoisting-works, and its main working shaft is thoroughly timbered throughout. Forty men are now employed by the company.

The next mine in point of importance as a producer and in development is the Last Chance, which is located on an east and west vein, and the main working shaft has attained a depth of nearly 200 feet. Four levels have been run upon the vein, three of which are run from an incline shaft sunk on the vein, and the fourth from an intersection of a cross-cut drift with the vein, this drift having been driven south from the vertical working shaft. Ore is said to show in quantities throughout the development, and it is reported that from 18 to 20 tons are hoisted daily from the 50 and 100 foot levels, one-half of which, being first class, is shipped to the smelter at Benson, Ariz., while the remainder is placed upon the dump until some future time when better facilities will enable the company to have it profitably treated; of this there is said to be an accumulation of several thousand tons, and in addition the different workings show immense reserves standing in the mine.

The vein measures 4 feet in width between walls, and the pay streak extends from wall to wall in most places, and the indications in the bottom of the shaft and lower level are said to give promise of permanency. About one car-load of ore is shipped daily, to produce which twenty-six men are kept constantly employed in the different workings. This mine is furnished with a good shaft-house and improved steam hoisting and pumping machinery, but has no plant for the reduction of its ores. It is owned by the Good Hope Mining-Company, which also owns others, but the principal efforts in the way of development are directed to the improvement of this property.

The Penelope is another promising mine owned by the Pyramid Company, the development of which consists of two shafts 72 and 60 feet in depth, both of which show the vein and ore, but not in a considerable quantity.

*Shakspeare district.*—This district is really a portion of the same mineral section in which lies the Pyramid camp, and, in connection with it, formerly formed the Virginia district. It lies about 6 miles north of Pyramid, in the northern foot-hills of the mountains of the same name.

The principal mine of Shakspeare district is the Superior. It is located on a quartz ledge of nearly 40 feet in width, and is opened by shaft to a depth of about 200 feet, as well as by an adit level run in on the vein from the foot of the hill. It is systematically developed by levels upon the vein to a considerable extent, all of which are said to show good mineral of a fair average width. Some stoping has been done, but as a rule the ore is left standing except such as is encountered in running the levels. At the depth mentioned the shaft is said to be in the same ore streak shown in the upper workings. The formation is granite, and the vein occurs in a contact of granite and porphyry. The ore is a green carbonate of copper, yielding from 20 to 35 per cent. in copper, 20 to upwards of 100 ounces in silver, and a small percentage of lead. It is generally shipped to the smelter at Deming for reduction. There are several hundreds of tons of ore on the dump of the Superior and the quantity is daily being increased in the prosecution of the work of development, in which from twenty to twenty-five men are kept constantly employed. This mine is furnished with first-class steam hoisting and pumping machinery, inclosed in a commodious shaft-house.

The Atwood mine, though lying idle for a portion of the year, is regarded as a very valuable mine. It has been developed by a vertical shaft to a depth of about 200 feet, and by levels at intervals run upon the vein. Considerable quantities of ore have been removed and now lie piled on the dumps. A cross-cut has been driven from the lowest level to the south vein, which is said to show up well. The indications are that the water-level has about been reached in this property, and its further development is being looked forward to with some anxiety, as the future welfare and prosperity of the camp will depend largely upon its success. No shipments of ore have been reported.

The Bonnie Jean and Jerry Boyle are also well-developed properties of this district, but no output of ore is reported from either. The Boyle is fitted with a fine steam-hoisting plant, and its main shaft has been sunk to a depth of over 200 feet without encountering any well-defined vein or ore bodies. A cross-cut has also been run, but without success. The ledge upon which it is located is large and prominent, and the quartz of the shaft is permeated with the characteristic metallic bases of the camp. The work of development is being vigorously prosecuted with the hope of discovering ore in paying quantities, for which the indications are regarded as good.

Upon the Bonnie Jean work is also being energetically pushed, and its main shaft has attained a depth of about 275 feet. A 65-foot crosscut at the 200-foot level has developed four distinct veins or spurs, the ore of which is said to carry copper, silver, and gold to the value of about $60 to the ton. The water-level was reached at a depth of 270 feet, which may somewhat retard further work for a time, as the mine is not yet equipped with proper machinery for deep workings. The purchase of a 50-horse-power engine and a complete hoisting and pumping plant has, however, been reported, and may even now be in place. No output has been reported, but the work of development is being confidently pursued, and it is intended to sink the main shaft to a depth of 500 feet without delay.

There are many other locations in this district, but those mentioned are the most important and are regarded as the pioneer developments. It will be observed that, with one exception, no producing mines are reported; it would therefore seem that the future must determine whether Shakspeare shall take rank as one of the important mining camps of the Territory. The spirit of enterprise and dogged perseverance exhibited in the prosecution of the work would certainly seem to merit success.

*San Simon district.*—This district lies southwest of Shakspeare, distant some 25 miles, in the extreme western portion of the county; indeed, a portion of the district extends beyond it into Arizona. No reports have been received from this district, as to the developments made during the year. It is known to contain some good properties, but litigation to a great extent, and want of necessary capital, has doubtless prevented the prosecution of the work of opening them.

*Eureka district.*—This district lies in the foot-hills of the Hatchita Mountains, in the southern portion of the county, about 24 miles nearly due south from Separ, a station on the Southern Pacific Railroad. The formation of the district is generally limestone, syenite, and porphyry, and the veins occur both as contact and true fissure. Though discovered in 1875 nothing of importance was done in the way of prospecting the mines of this district until comparatively a recent period, owing to danger from hostile Indians, and no less vicious and malignant ruffians, who roamed this portion of the county at will, as well as to their distance from the older camps and railroad communication. Within the past year, however, all difficulties have apparently been surmounted, and the district is now, perhaps, as thriving as any of the new mining sections of the Territory.

The Hornet mine is the most extensively developed of the district, its main working shaft having attained a depth of about 170 feet. In addition it is opened by levels, from which drifts have been run to connect with the vein. The ore is carbonate of lead in character, most of which is free milling, though the higher grades are most economically reduced by the smelting process. During the year about 300 tons of this class of ore have been shipped, returns from which gave an average of 140 ounces to the ton in silver. Some 1,500 tons now on the dumps were produced in the same length of time. The mine though supplied with a 30-ton smelter, has never been operated successfully, and is now idle, but it is intended to put it in thorough repair and in blast as soon as practicable.

The company owning the Hornet also own the Bonanza and Nabob, as well as some 400 feet of the ground of the King. Upon the two first little work of consequence has been done, but upon the fractional claim a shaft has been sunk to a depth of 110 feet upon the vein, which is said to make a good showing of ore at the bottom. This shaft is supplied with good hoisting machinery and an excellent shaft house, but from some cause work has been temporarily suspended.

The King is also regarded as a promising mine, and has produced some good ore. It is opened by shaft to a depth of over 220 feet. For the first 60 or 70 feet the vein showed a width of from 1 to 3 feet of high-grade ore, returns from 40 tons of which gave 200 ounces in silver to the ton. At the depth mentioned the vein pinched to a mere seam, but the work of sinking has been continued by three shifts of hands in the expectation of striking it at greater depth, in which the indications prove they are not liable to disappointment. In addition to the ore shipped there are now some 150 tons on the dump, which, with careful sampling, it is said, will average about $60 to the ton. The shaft is equipped with good steam-hoisting machinery and suitable buildings.

The Eureka Central is opened by shafts 70 and 90 feet in depth. The latter, being the main working shaft, is sunk vertically. Where the vein has been exposed it is shown to be about 2 feet in width between well-defined walls, one-half being taken up by the pay streak, which gives an average value of upwards of $100 to the ton in silver. Some ore has been shipped from this mine, which is said to have given high returns.

The Eureka Company also own the Silver Queen, Silver Crown, Little Alice, and Jonesy, upon all of which considerable development has been made, and all are represented to be promising. They are on a contact vein between limestone and porphyry. The ore of the Little Alice is said to be galena, while that of the others is a carbonate.

The American mine is located on a ledge between the Hornet and King properties. Its development consists of two shafts upwards of 50 feet in depth and some 300 feet apart, in each of which the vein exposed is shown to be from 4 to 5 feet in width, carrying an average pay streak of 3 feet. Other openings on the ledge show the vein to be continuous, as described, for a distance of upwards of 400 feet. The ore is not high grade, but the size and continuity of the vein make it a valuable property. A car-load shipped to Pueblo gave returns of $41.50 in silver to the ton, which is regarded as a fair average of the production. The ore is galena and carbonate, but does not carry sufficient lead to prevent it from being free milling. The silver contained occurs generally as a chloride, but rich sulphides are found quite frequently. Work is at present being vigorously prosecuted, principally in the way of surface development, however.

The Howard is one of the oldest locations in the district, but it is developed less extensively than many others. Its shaft has been sunk to a depth of about 50 feet, but the principal work now being done is on the vein, at the 40-foot level, upon which drifts are being run in both directions. Some 100 tons of ore of fine grade is now on the dump—it is galena, carrying both chloride and sulphide of silver.

Within the limits of the district, but some 2 miles from the principal locations and developments, is Dug Out Camp, regarded as a very promising section. The locations are made on a limestone ledge that seems to be permeated in every direction by stringers or spurs ranging from 6 inches to a foot in width, of good, high-grade ore. In one instance, and that within the year, the vein was uncovered, where it showed a width of 2½ feet of ore of good assay value. An old adobe smelter is used here by the miners, who manage to convert the lower-grade ore into a matte worth from $500 to $600 per ton.

It is impossible with the space at command to mention all the mines of Eureka district. The California, Lone Star, Antler, Reno, Bunko, Hidden Treasure, Julia, and Homestake are a few of those that are worthy of special notice.

In addition to the smelter already spoken of, another has been erected by the New Mexico and Illinois Company, that is reported to operate successfully. A good quality of iron ore is said to have been recently found; no further difficulty will, therefore, be occasioned by the want of it for fluxing purposes. The matter of coke will, however, be a serious hindrance, as the expense of procuring it from Trinidad is very great.

Sunny Slope Camp, 5 miles south of Hatchita, has two properties upon which some work has been done, showing a vein which yields 15 per cent. in copper, and carries considerable silver.

Granite Gap Camp is 14 miles south of Hatchita. One location in this camp has been somewhat developed, and is reported to show well in galena ores.

*Monument* and *Fremont districts* lie 15 miles southeast of Hatchita, near the Mexican border. These are adjoining districts, and are reported to be remarkable for the masses of their lead and copper ore bodies, some veins yielding as high as 60 per cent. of the latter. Want of water has been a serious drawback in the development of the mines of these districts.

Apache Camp is another of these detached districts in which some prospecting has been done and a few promising locations made.

*Cedar Grove district.*—This district lies northeast of Eureka, and about half way between it and Victoria district. Quite a number of locations have been made here, upon some of which considerable development has been done. The Viola, Cedar Grove, Red Warrior, Continental, Continental No. 2, Chieftain, and Pittsburgh are the principal of these.

The Continental No. 2 is opened by a shaft to a depth of about 80 feet, and shows a vein of 3-foot ore, from which assays ranging from $30 to $300 to the ton in silver have been had.

The Viola has a shaft some 60 feet deep, and also shows a good character of ore of high grade. One shipment, unassorted, is reported to have given returns of $300 to the ton in silver. The other claims have had less work done upon them.

*Tres Hermanas district.*—This district lies in the extreme southeast corner of the county, about 28 miles south of Deming. Its principal mine is the Cincinnati, which is opened by a shaft upwards of 150 feet in depth. The ore is galena in character, running about 30 per cent. lead and carrying a high value in silver. Shipments at the rate of two car-loads per week are now being made from Deming to Pueblo and Kansas City smelters. The returns aggregate $15,000, or an average of $120 per ton net, for 125 tons shipped. About as much more lower-grade ore remains upon the dump, and will be utilized when the Deming smelter is put in blast.

The Yellow Jacket has been developed to some extent, and makes a good showing of high-grade ore, of which about 10 tons are already on the dump.

The General Hancock and Toledo are also reported to be promising claims.

*Carizillo district* lies about 15 miles south of west from Tres Hermanas. It is comparatively an old mining district, but nothing of interest in the way of development of its mines during the year has been received.

Southeast of Deming, about 10 miles distant, is the *Florida district*, which is rich in the production of lead in its various forms. The ores from the mines are very valuable as fluxes in addition to the intrinsic value of the lead and silver which they carry. No report has been received from the district, except that work is being vigorously prosecuted on some of the locations with good results.

The production of this county during the year 1883 was $1,200,000 in silver and $110,000 gold.

## LINCOLN COUNTY.

*White Oaks district.*—The development of the Little Mac has been continued during the year, and the main shaft has now attained a depth of about 300 feet. It has five levels at intervals of 50 feet, running north and south. The first, or 50-foot level, is opened a distance of 50 feet; the 100-foot level upwards of 300 feet; the 150-foot level about 75 feet; the remainder are simply located. Considerable stoping has been done in the 150 and 300 foot levels, and about 300 tons of ore have been extracted during the year. The vein of this mine is about 6 inches in width, and is rich in gold.

But little more than the development work required by law was done on the North Homestake during the year, the main shaft of which is now down about 200 feet. It is opened by levels at a depth of 100 and 200 feet, but the work has been insignificant.

The Solitaire has produced about 400 tons of ore during the year 1883. This is a location upon the surface ground of the north end of the North Homestake, some 750 feet from the old shaft. The vein is regarded as a new one. Its main shaft has reached a depth of about 100 feet; considerable stoping has been done in both the 50 and 100 foot levels. The width of vein is about 2½ feet, and the ore averages about $15 to the ton.

Upon the South Homestake no work was done during the year, but some of the ore upon its dump has been milled. Litigation respecting the ownership of these mines has doubtless done much to retard operations.

The Ora Cash and Rita mines are opened by shafts to a depth of about 45 feet each. The vein of the latter averages about 2 feet in width. Mill runs of $25 to the ton in gold have been had from its ores. This is a recent discovery, and is regarded as a very promising mine.

The Lady Godiva, also a recent discovery, bids fair to become a valuable property. No details of development are furnished.

The Henry Clay has been opened by a tunnel 300 feet in length, a 200-foot level, and a drift upon the vein of about 150 feet. The vein is 6 inches in width.

A large body of low-grade ore, about 9 feet in width, has been uncovered in the Old Abe during the year. The ore is a light-colored quartz, carrying visible free gold in considerable quantities. The work in this, as in most of the mines of the district, was prospective and for development purposes only.

Two gold mills are located in the town of White Oaks, in this district, one built in 1881 of ten stamps, which has been exclusively run on custom ore. It is said to lack most of the modern appliances for the economical working of ore. It has not been in constant operation and the production is reported at about $7,000 in gold, obtained from 400 tons of ore operated upon. The Chandler mill was erected during the year 1883, and since its completion has run upon ores from the Little Mac, North Homestake and other mines of the vicinity. It has two Parker pulverizers, which are found to be unfit to operate the tough, refractory ores of the district. It is reported to have worked some 350 tons of ore and produced about $6,000 in gold bullion. A new gold mill is in contemplation at this place, and will probably be erected in the coming year. It will be furnished with all the modern appliances, with a view to overcoming the difficulties now experienced in the treatment of the peculiar ores produced by the mines of the district.

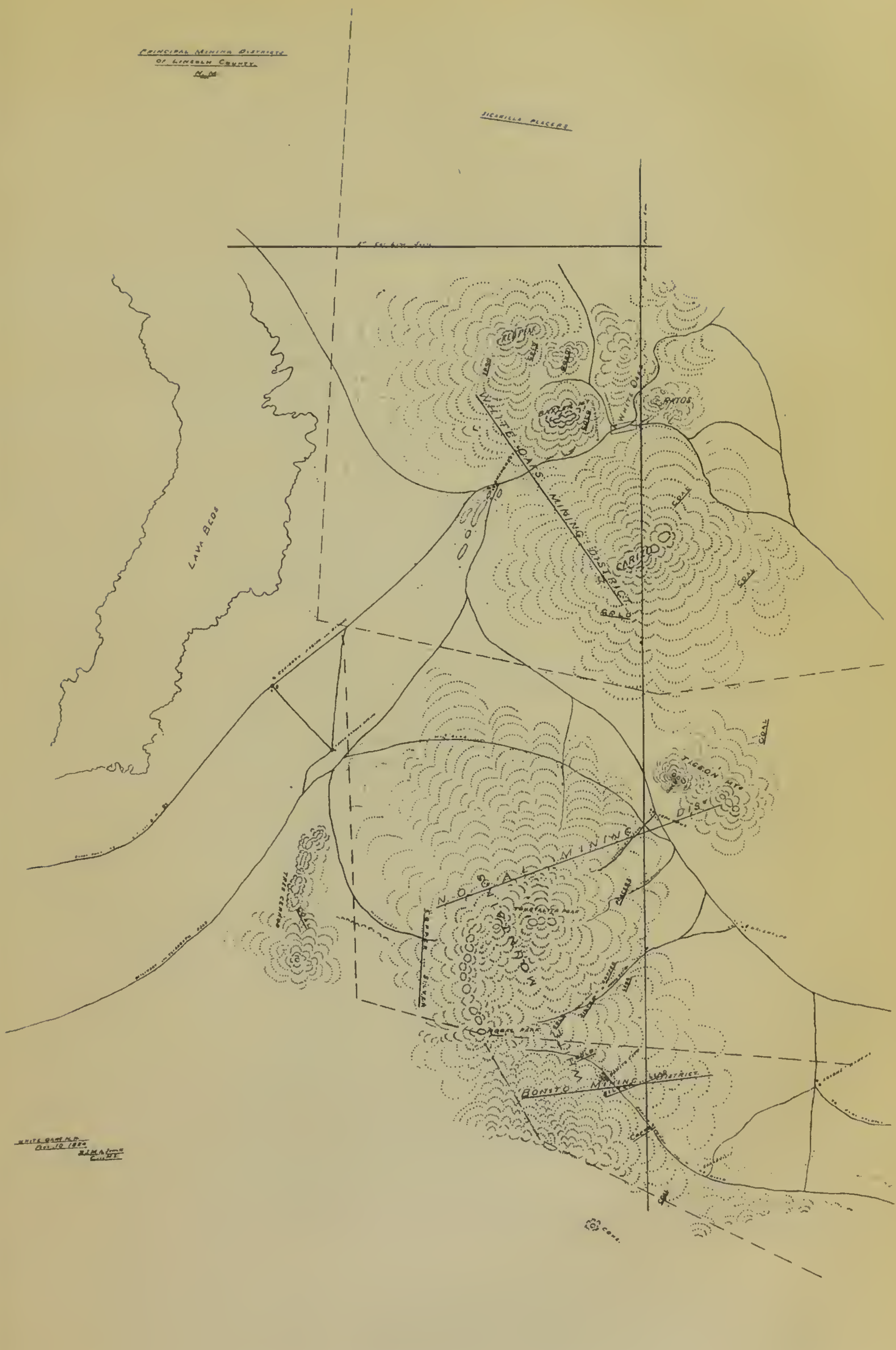
*Nogal district.*—This district lies 20 miles south of White Oaks. The Vera Cruz, located on a spur of the Ticson Mountains, is the principal mine of this district. It is especially remarkable for the wonderful width of its lode, which measures 63 feet between well-defined walls. The ore produced is not, however, high grade.

The Rockford is reported to have been developed during the year into quite a promising property. The Fletcher mill, of fifteen stamps, was erected in the latter portion of the year to treat its ore; but after having been in operation for a few days it was suspended, owing to difficulties which arose between the owners of the mill and those of the mine. There are a number of other excellent prospects on the same lode with the Rockford.

*Bonito district.*—This district lies still farther to the south, distant about 10 miles from Nogal Cañon. It is not claimed that it has as yet been a producer of the precious metals, but the following from the pen of a correspondent at Bonito, N. Mex., Charles Metcalfe, esq., postmaster, indicates that in time the district will take rank as an important mining camp. Latest advices show that machinery for the reduction and treatment of ores is now being put in place:

The Bonito district, in Lincoln County, is situated 30 miles south of White Oaks, 16 miles west of Fort Stanton, and its nearest railroad point is Socorro, 100 miles distant. In the summer of 1882 the portion containing the mineral belt was cut from the north end of the Mescalero Indian Reservation, and the district is now in its second year. It extends about 10 miles east and west, and includes the headwaters of the Rio Bonito, by which it is drained, and which furnishes the camp with an abundant water-power for all mining and other purposes. The center of the district is in the heart of the White Mountains, and at its lowest point has an altitude of 7,500 feet. High mountains rise on each side of the main stream and its dozen feeders—Blanco peak being 13,000 feet. Heavy timber covers the whole district, consisting of spruce, pine, oak, cherry, maple, and locust. The country rock is granite, interspersed with dikes of trachyte and porphyry, while fissure veins of quartz form a regular net work and the outcroppings are traceable long distances. The predominating ore is silver-bearing galena, showing some copper, and also carrying gold and nickel. About three hundred claims have been staked, from which we select the most prominent from present development.

The Rosa has been opened for 100 feet, a tunnel having been run on the vein at the base of a mountain to that depth. This tunnel can gain a depth of 500 feet, and like most other properties in the district, be made self-draining to that depth. The vein has been from 4 to 10 feet



Principal Mining Districts of Lincoln County, N.M.

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wide and mill runs $33. Concentrating works will be erected to treat the ore.

Parallel with the Rosa vein, in the same locality, are two other well-defined leads, on each of which are a number of locations. The Mogul and the Baby mine adjoin, each having about 50 feet of work and showing large bodies of galena ore. The other lead has three promising locations, the Renown assaying from 15 to 137 ounces in silver, the Hyronemous and the Orphan Boy showing the same mineral. These veins run nearly east and west.

Crossing these veins nearly at right angles is the Cricket lode, which on the surface shows ore carrying visible gold and native silver. At 85 feet the character of the ore changed to a smelting ore, running 60 ounces in silver. The vein is from 5 to 9 feet wide, and three locations have been made on the lead.

The Czar, the Silver Glance, the Laura B., the French, and the Troubadore are all promising propects in the same locality, having from 20 to 75 feet development and assaying well in silver.

About 1 mile down the stream is another group of mines, the most prominent of which is the Chinaman, which is now at a depth of 200 feet and has a 5-foot streak of galena ore, which mill runs 47 ounces. This is an east and west vein. In the same neighborhood is the Treasure, assaying $75, and the Glow-worm, which runs 60 to 110 ounces in silver. The Bent lode shows 100-ounce ore, and assays from the Ville de Marselleis have gone as high as 1,500 ounces in silver.

The Christmas was one of the early discoveries of the camp, and ranks as one of the richest mines. It yields 300-ounce ore and assays as high as 1,900 ounces in silver. It is developed with 200 feet of shafting and tunneling.

The Tip Top, an extension, assays 475 ounces.

The Neptune, with a 4½-foot lead, assays from 15 to 200 ounces.

The Saxionia, at 25 feet, assays $180.

The Shawnee is 60 feet deep, with a 4 foot vein.

The Yours Truly is a bonded vein, and assays as high as 1,086 ounces in silver. From thirteen assays an average was returned of 153 ounces.

Still another group, in Krauk Gulch, show considerable gray copper. The Hope is developed 50 feet, and is one of the best prospects of the camp.

The Hunkidori is a wide vein of carbonate ore running $35 in silver and 45 per cent. lead.

The Oreland is tunneled 75 feet, with a winze 30 feet, showing a 4-foot vein assaying $30.

The Mineral Farm has a shaft 100 feet deep, showing a good vein of low-grade ore.

The Ojo Blanco has a 60-foot tunnel, showing a 4-foot vein.

The Mazeppa has a shaft 50 feet deep, assaying as high as $180.

The Wisconsin and the Kansas show a large body of galena.

The Black Diamond and the Boston, in the same locality, are reckoned among the best properties of the district.

The Silver Nugget assays at 25 feet $485.

These veins contain quartz, heavy spar, feldspar, and fluor-spar. Within 8 miles can be found lime and coal, and several iron veins course through the district.

Two mines, the Baby and the Chinaman, have been patented.

The Lone Mountain Gold and Silver Mining Company of Delphi, Ind., is one of the strongest companies operating in the camp. This, together with three others, will develop their properties during the year. With the facilities mentioned smelting works are only needed to make it a producing camp.

*Gallinas district.*—North of White Oak some 60 miles is located the mining district of this name. It is near the wagon road to Las Vegas, in the extreme northwestern corner of the county. The development of this district is not in a forward state, no bullion having as yet been produced, except $93 from the Buckhorn, which was obtained from a trial run of 1 ton of ore sent to the Billings smelter at Socorro This mine and the Tenderfoot are the principal developments of the district.

The Buckhorn is opened by a shaft to a depth of 125 feet. The vein is 3½ feet in width, carrying a pay streak of silver and copper. The ore body in sight is reported large, and $93 is regarded as a good average of the better grade of ore. The percentage of copper is not reported.

The Tenderfoot is about equal in point of development to the above, and in the quality and quantity of its ore it is also similar.

A small "Jim Crow" smelter has been erected for the reduction of the ores of these mines, but it has proved worthless for the purpose, and the camp is consequently without necessary reduction works. Aside from these there are a great many other locations, some of which have been partially developed, but the two mentioned are said to be the only ones of any promise as ore producers. The Gallinas district is blessed with an abundance of timber, but, as is the case with many other important mining sections, it is hampered by a scarcity of water.

The total gold production of Lincoln County for the year 1883 is estimated by D. J. M. A. Jewett, esq., to have been $24,500. This amount includes about $9,500 produced from placer workings in different parts of the county. The same authority reports that there is as yet no machinery in place for the treatment of silver ores, and that in consequence no silver bullion has been produced in the county. Ores estimated at about $8,000 in value have, however, been shipped to other points, principally to Socorro and Las Vegas. After accounting for the meager output for the year, Mr. Jewett proceeds to say "that the production of 1884 will make a creditable showing. The coal-veins at White Oaks have been finely developed, and await the advent of a railway to supply all demands. The coal is of fine quality, and may be coked in open yards. This being the case, no competition either in quality or price will be possible in New Mexico after the advent of the railroad. Lime and iron of excellent quality are found in the Lone Mountain northwest of White Oaks, 2½ miles distant, and this fact, with coking coal 1½ miles distant in the opposite direction, seems to point out this town (White Oaks) as, above all others, the best point at which to locate smelters."

The accompanying map, showing the locations of the various mining districts of Lincoln County, was furnished by Mr. Jewett, who is thoroughly acquainted with the mineral-bearing sections.

I estimate the production of this county at $24,000 in gold and $10,000 in silver, but little more than half that of 1882.

## MORA COUNTY.

In the extreme northwestern portion of this county a strike is reported in the Poverty Hill mine. The district is located near the town of Ocate, on Ocate River, a tributary of the Canadian. The Poverty Hill mine is the principal property of the district, and has been considerably developed by a company of the same name. The ore is a carbonate said to be free milling, and of sufficiently high grade to be mined with profit. Two shifts of hands are employed in the various workings. An acequia, or ditch, can be run from the Ocate River to the foot of the hill, some 75 feet below the mouth of the mine and a mill and sluice ways built. All necessary machinery for the crushing and treatment of the ore will, it is reported, be placed on the ground at an early day. This district is about 30 or 35 miles south of the rich placer section in Colfax County, and in the eastern foot-hills of the Rocky Mountains.

## RIO ARRIBA COUNTY.

The last year's developments in the northwestern portion of this county are reported to give promise of a golden harvest in the Headstone district. That the discoveries are believed to be valuable and permanent is evidenced by the fact that a stamp mill has already been erected by a company of Boston capitalists, for the reduction of the ores from the lodes of the district, all of which are said to be free-milling gold quartz of good grade. A good many locations have been made and considerable work has been done on the various leads, and sufficient ore is now being mined to supply the mill. Thus far, however, placer mining has been the principal industry, and is regarded as the more important, though it cannot be pursued during the winter season, owing to the immense snow-falls. The placers are said to be quite rich, each pan of gravel showing from thirty to forty colors to the naked eye. A dam 180 feet in length by 30 feet in height has been constructed to form a reservoir, said to have sufficient capacity to supply the miners during the entire summer. These placers are at Goodhope Camp, which is now composed of about two hundred men, living in adobe huts. A saw-mill has been built and other improvements have been made indicating a permanent camp. Wood and water for all purposes are reported to be abundant in the vicinity.

## SAN MIGUEL COUNTY.

The city of Las Vegas, the county-seat of this county, has been excited over what is reported to be a wonderful discovery of gold in the very center of the city, and in the hills and valleys around it. The discovery was made in an excavation for the foundation of the new court-house by an old California miner, who, noticing the earth and black sand as it was thrown up, concluded that it must contain gold. Acting upon this belief, a quantity of the gravel was secured and privately washed, with the result as reported of finding gold in paying quantities. The ground was immediately staked by the prospector and his friend, since which time almost every available spot within a radius of 2 miles of the town has been staked off as a placer claim. The excitement has even extended to Hot Springs, some 10 miles up the Gallinas Valley, where claims have also been staked. A half cubic yard of the earth taken from the court-house excavation was regularly sluiced under test conditions, and is reported to have yielded upwards of 10 grains of pure gold of the value of 42 cents, at the rate of $1 per pennyweight. What this find will result in must be determined by future developments. To this end a company has been formed with a view of excavating down to bedrock.

A number of locations on gold quartz lodes were long since made near Las Vegas, but were soon abandoned because the gold contained in the ore was not sufficient to make the work profitable. This new strike may stimulate the prospector and result in the discovery of the mother lode, the source of these placer deposits, the result of ages of erosive action.

### SANTA FÉ COUNTY.

The enterprise of those in this county interested in mining appears from reports received to have been well rewarded. Heretofore the southern portion of the county has been regarded as the only mineral section, but recent discoveries and developments show fine deposits of both gold, silver, and copper ore as far north as Santa Fé. Unless the reports are exaggerated, the Santa Fé range of mountains may yet equal in mineral wealth the Black or Mimbres ranges, in the southern portion of the Territory.

*Los Cersillos district.*—Notwithstanding the fact that the smelter at Cersillos has been idle for something over a year, many of the mines of this district have been worked with energy and perseverance. Among the most prominent of these is the Bonanza No. 3, which is reported to have attained greater depth than any other in the district, its main shaft being about 275 feet deep. The vein at this depth is of good body, and is found to be a fissure between smooth and well-defined walls. The ore is galena carrying silver, and a high per cent. in lead. The mine is furnished with improved hoisting and pumping machinery.

The Cash Entry is also an important mine of Cerillos district. It is opened by three shafts, two on the main vein and one on the other; the shafts on each being connected at a depth of 130 feet by a level 150 feet in length. The main vein shows an ore body of from 18 inches to 10 feet in thickness, the other vein is only about 1½ feet in width with pay streak from 2 to 10 inches. The ore is also galena, carrying $10 in silver to the ton and 30 per cent. lead in the larger ore body, and $50 in silver and from 45 to 50 per cent. lead in the smaller. The last 120 feet of development are said to have been driven through solid ore. Twenty men are employed in drifting and cross-cutting, and otherwise developing the deposits. The mine is thoroughly timbered and supplied with good hoisting and pumping works. Several thousand tons of ore are now reported on the dump and many thousands more exposed in the various workings.

The Lucky is developed by a shaft about 40 feet deep on a strong vein of good paying ore, several car-loads of which have been shipped to the smelter at Socorro, and gratifying returns are reported to have been received. Eighteen miners are employed in the work of development.

The Sesame mine is also said to be opening up well. It is developed by a shaft to a depth of 35 feet, on an 18-inch vein of good mineral.

North of Carbonateville, which is about the center of Cerillos district, is the town of Bonanza, in the vicinity of which is located the Marshall Bonanza mine. Until within the past two months no work had been done on this property during the year, owing to misunderstandings among the owners, which resulted in legal proceedings. The difficulties have finally been adjusted, and the work of development has been resumed. The mine is opened by a shaft to a depth of about 200 feet, and by various levels, drifts, &c., about the water-line, which was reached at a depth of about 165 feet. A second shaft has been sunk for ventilating purposes about 500 feet north of the working shaft. This is operated by a whim, and it is intended to drift southerly, to connect with the other levels. The main shaft is furnished with fine steam-hoisting machinery and commodious shaft house, and other necessary buildings. The vein of the Bonanza is said to measure from 2 to 5 feet in width, and extends throughout the entire length of the claim. The ore is a medium grade galena.

The Aztec is another mine, near the Marshall Bonanza, upon which work has been carried on with considerable activity during the year. It is opened by four shafts, the deepest of which is about 75 feet, and by a tunnel, cross trenches, &c. The ore is a chloride of fine quality, carrying both gold and silver.

Great Western.—The shaft of this mine has attained a depth of nearly 220 feet. Its ore body is reported to be quite large and to run remarkably well in silver.

The Painter Boy is also reported favorably. The shaft has reached a depth of about 50 feet, showing a 20-inch vein of lead carbonates, which is said to improve as depth is gained. The ore carries considerable silver and some gold.

Reduction works were erected in the town of Bonanza during the early part of the year and have been in operation since. These works concentrated low-grade ores to three or four times their original value at a trifling expense, which enables the owner to ship and realize a profit upon ore that would otherwise not pay for handling. The plant is perfect in its way, and the buildings are substantial and commodious; the capacity is from 30 to 40 tons every twenty-four hours. Arrangements are being made to resume operations at the Cerillos smelter. Suit has been brought with a view to forcing it into the hands of a receiver, but before this comes to trial it is believed that the difficulties will be adjusted by compromise and operations at once be resumed. This smelter has a capacity of 30 tons a day, and is said to be one of the best in the Territory. Its buildings are substantial and its machinery of the most approved kind.

*New Placers district.*—This district comprises almost the entire southern portion of the county. Its principal town is Golden, which is situated almost in the center of the district north and south. These placers have been repeatedly described and their richness is acknowledged. The question that remains to be solved is how to obtain water to utilize them. This has been attempted by boring artesian wells, which proved successful in the immediate vicinity of Golden, on the Davenport property, where a number of wells have been sunk, and one, at least, affords a good supply, but this for placers so extensive can only be regarded as a mere beginning. About 2½ miles below Golden the Tuerto has been dammed and furnishes a reasonable supply of water. Some twenty-five men are working at this place, and it is reported that they are making good daily wages by the old hand-pan process of washing.

A new invention termed the Dry Placer Amalgamator has been in operation on the Davenport placer during the past year, and reports from it are said to be very flattering. It is claimed for this amalgamator that with a 10 horse-power engine it has capacity for treating about 50 cubic yards per hour. The daily average for gravel or dirt thus far treated is reported to be 300 cubic yards, and the product from $1 to $1.25 per yard. It is further claimed for this machine that it extracts a higher percentage of the gold contained than can be obtained by sluicing or any other process. Though termed a "dry amalgamator" some water is needed in operating, but three-fourths of the quantity used is saved by the use of a settling tank. Other machines of this patent, as is stated, are to be put in operation in the coming year, and it is confidently expected by those interested that they will prove very valuable. It is evident that the wells in question can supply sufficient water for a number of these, while they would fail to furnish the quantity necessary for extensive sluicing or hydraulic operations.

The lodes of this district are reported to have been actively prospected and developed during the year and with gratifying results. In nearly every instance, both in the Ortez and Fuerto and San Ysidro ranges, where developments were made, ores of greater or less value were encountered. Some are now producing ore of good grade, and many others show good indications and are considered promising properties. The mines of the last-named range have generally silver-bearing veins, whilst in the former ranges the lodes carry gold, silver, copper, and iron. Many of the mines of this district that are known to be good producers are located on old land grants and are now lying idle, their titles being in dispute between the owners of the grants and those who developed them. These conflicting interests, until finally arranged, will operate as a serious hindrance to the mining industry of the district.

After having lain idle for some time the ten-stamp mill at Golden was thoroughly refitted in March last, and since then has been in operation treating the ores of the district, but no report of bullion output has been received.

The smelter of the San Pedro and Cañon Del Agua Company, at San Pedro, was run during the first nine or ten months of the year on the product of the mine of the same name, and shipped upwards of 425 tons of bullion (copper). Its operations were interrupted for several months by parties taking unlawful possession of its mine, but its difficulties have now been arranged and it will likely resume operations at an early day. The value of the copper output alone could not have been less than $75,000 during the time the smelter was in blast. The company's mill is also located at San Pedro, but whether in operation during the year, or any portion of it, has not been reported.

*Pecos district.*—This district lies in the eastern edge of the county, near the village of Hamilton, about 16 miles from the city of Santa Fé. Its principal mine is the Katydid, the shaft of which is down something over 50 feet, and two cross-cuts have been driven at a depth of 50 feet, which show the vein or ore body to be 29 feet in width. From assays made it is estimated that the ore will average $70 to the ton, in copper and silver. A force of eighteen men is employed in the various workings, and from 5 to 8 tons of ore are being produced daily. The shaft is furnished with complete machinery for hoisting and pumping purposes.

Aside from the Katydid, the Pecos River Mining Company owns twelve other claims near Hamilton, only one of which, the Evangeline, has been developed to any considerable extent. Wagon roads from this camp are being constructed to the railroad and coal mine, the latter being less than a half mile distant. Smelting works are also in process of erection, and will be completed early in the coming year. This new camp, from all accounts, is certainly very promising. With an ore body that, so far as developed, appears to be immense, a supply of excellent coal for fuel less than a half mile distant, and abundant wood and water close at hand, the camp may reasonably expect to develop into a prosperous mining center.

*Santa Fé district.*—The latest mining district of the county is that discovered in November last about 3 or 3½ miles northeast of Santa Fé, in the foot-hills of the Santa Fé range. Gold has recently been found in paying quantities in the gulches receiving the wash from these mountains, but the deposits have never been worked, owing to the difficulty of obtaining a sufficient supply of water. These placers, being especially rich in the vicinity of the place where the discovery referred to was made, suggested the idea that the lode from which the deposits came might be found in the neighborhood, and a search was at once instituted by a Mr. Breeden, an intelligent prospector, and the result was the finding of the ledge upon which the Coronado has been located. The development of this mine consists of an open cut some 60 feet in length, which cuts the vein at a depth of about 30 feet. At the intersection of this cut the vein matter is 9 feet in width, between smooth, well-defined hanging and foot walls. Assays have ranged from $80 to nearly $500 in gold to the ton. The vein is regarded by all practical miners who have seen it as a true fissure contact, giving promise of permanency. Many other locations have been made in the vicinity, and should this develop into an important mine, the proximity of the district to the city of Santa Fé will render it unusually valuable. This city is the commercial and financial center of the Territory. The development of the district need not, in consequence, drag for lack of necessary capital, that hindrance to so many important mining localities.

A new copper field has also been opened up in this county, some 8 miles to the southeast of Santa Fé, which is said to be very promising. Thayer Camp is the name of this new district. On the Naomi a shaft has been sunk to a depth of over 40 feet, all in pay ore. The vein is said to be fully 4 feet in width and to be widening gradually as the work of sinking progresses. The assays made show 19, 25, and 33 per cent. of copper. The owner of this mine proposes to continue his shaft to a depth of 60 feet, and if the vein continues as promising as thus far developed, he will at once undertake to furnish the new smelter at Santa Fé with ten or twelve wagon-loads of ore daily. Many other locations have been made, but this is the only one showing development. In the vicinity of this camp some development has also been made on a gold prospect named the Ashton, but whether it will result in opening up a good property yet remains to be proven.

The county's production for the year was $10,000 in silver and $15,000 in gold.

## SOCORRO COUNTY.

Mining in this county has been prosecuted during the year with reasonable energy and vigor. Strikes in new discoveries as well as in old mines have been made, and are no longer regarded as unusual events, but are looked upon as natural occurrences in the progress of development. The industry consequently is being pursued quietly, steadily, and without undue excitement. As a result mines are being wisely and systematically opened. The experience of the past has also been utilized in enlarging, improving, and perfecting during the year the necessary machinery for milling and smelting the product of the mines. The plants of Socorro have especially been put into the best possible condition for profitable and economical reduction.

*Polomas district* is located in the southern portion of the county, bordering on Grant. The district is a large one, and contains some very promising mines, as shown by the following description furnished by my correspondent at Chloride, Socorro County, New Mexico, Richard Mansfield White, esq.:

This district is about 12 miles square, and is situated south of and adjoining the Apache mining district, nearly due north of Lake Valley and Kingston. It is about 45 miles westerly from Engle Station on the Atchison, Topeka and Santa Fé Railway, and on the easterly slope of the Black Range or Mimbres Mountains. The country rock consists of porphyry, syenite, trachyte, schist, limestone, talcose and clay slates, shale, quartzite, and porphyritic conglomerates, which have been contorted, faulted, changed, chasmed, and eroded until the rock-building of ages is exposed to view and successive periods of time are plainly marked as the many volumes of a book with its subdivisions of chapters and clauses. In and between these rocks the mineral wealth of the country is found in fissure, contact, bedded veins, and deposits. The principal paying mines as yet discovered are in the limestones, and may be divided into two classes: those occurring near the contact of the limes and the porphyries; those occurring between two great faults, which rive the limestones perpendicularly and are of northerly and southerly strike. This lime belt is of general northerly and southerly strike, and about 80 miles long; being the middle section of the lime belt in which the mines around Kingston, Chloride, and Grafton are found.

The principal mines along the lime and porphyry contact are:

The Silver Brick, which is the southern extension of the American Flag. The vein is 30 feet in width, with a pay streak of 3 feet; it is of close-grained quartz, carrying sulphides of iron, copper, and silver, with some oxides of iron and copper; average of three assays was 150 ounces silver to the ton. The development consists of a shaft 60 feet in depth.

The American Flag, the principal lode of this series, shows a noble outcropping of quartz 30 feet in width, fine-grained and granular, with cavities, the interior of which are studded with quartz crystals and native silver; the ore body is 12 feet in width. Iron, copper, and silver sulphides, copper carbonates, silver antimonide and native silver in grains, blades, and twigs are distributed through the quartz, making a rich ore of brilliant and attractive appearance. Assays as high as 13,000 ounces in silver have been made; a shipment of 5 tons of ore returning 179 ounces to the ton, a second shipment of 11 tons returning 275 ounces. This mine has three shafts, one of 50 and two of 10 feet in depth. The strike of the vein is northerly and southerly. A car-load of ore has been sent to Denver for treatment, which returned 275 ounces in silver to the ton, and another car-load of first-class ore is about ready. There are about 80 tons of second-class ore on the dumps.

The Flagstaff is a parallel vein to the American Flag, and is adjacent to it. The vein is 20 feet wide, carrying iron sulphides and oxides, copper carbonates and sulphides, silver sulphides, chlorides, and native silver. The developments consist of a shaft 20 feet in depth and open cuts.

The American Flag and Flagstaff were formerly known as the Massive and Nourse, being so described in last year's report, but they were abandoned, were located again and have been sold to a company of which Mr. Alexander Bently is manager, who is rapidly developing them.

The Mejicano has a shaft 55 feet in depth with two drifts each 15 feet long, showing a vein 19 feet wide with an ore body 4½ feet in width, carrying copper carbonates and sulphides, silver sulphide and antimonial; it is a contact vein between lime and porphyry of northerly and southerly strike and westerly dip.

The Antelope is a lenticular vein or succession of lentiform secretions in the lime near the trachyte of quartzose and talcose gangue, carrying iron and copper sulphides, silver sulphide, antimonial sulphide, and native silver, also graphite and manganese; assaying from 30 to 640 in silver to the ton. It is worked by two shafts 18 and 40 feet deep, with drifts 20 feet in length.

These mines are situated on the westerly slope of the lime belt, and within one mile of Hermosa, the town of the district. Passing down the cañon of the Polomas River, which divides the lime belt easterly and westerly for a depth of about 1,000 feet, nothing of importance is reached until that portion of the limestone is encountered bounded by the two faults before mentioned; these faults split the successive layers of limes, slates, and shales vertically from below the river bottom to the sky line. On the southerly slope of Carbonate Hill and between these faults below the slates and in the lowest limestone, which have been greatly changed, the stratification lines being obliterated in places, are found the outcropping of a series of veins. The chief mines here situated are:

The Pelican, developed by two adits 20 and 125 feet in length with two drifts 20 and 10 feet in length. It is a bedded vein of large size and continuity, with spurs or tributary branches, the main vein being from 3 to 10 feet in width, of lead carbonates and sulphides carrying silver; copper carbonates, iron oxides, and balls of spherosiderite also occur; the ore of one of the spurs showing large percentages of copper carbonates, iron oxides, and argentiferous galena, making an ore of rich and variegated appearance. The westerly heading of the 20-foot drift is in cube galena, which assays 80 per cent. lead and 51 to 130 ounces in silver to the ton; an average of 10 feet in depth of carbonates and galena gives 45 per cent. lead and 35 ounces silver. The heading of the 125-foot adit is in a fine body of carbonates and galena.

The Albatross, an eastern extension of the Pelican, is developed by three adits, 108, 35, and 27 feet long. It is a vein of unknown dimensions, the ore returning 50 to 106 ounces in silver to the ton.

The Embolite lies east of the Albatross, and is a bedded vein of unknown size of quartzose, calcarious and argillaceous gangue, carrying bromo-chloride of silver; assays from 15 to 50 ounces silver. The developments consist of four shafts and four open cuts.

The Polomas Chief is a vein of northwesterly and southeasterly strike, of unknown dimensions as yet, of dark gray to blackish quartz and talc, the quartz being finely granular and crystalline, the talc occurring as selvages or envelopes to the ore bodies, which are brilliantly and variously colored by iron oxides, sulphide, and carbonate, copper oxides, sulphides, and carbonates, lead sulphide, silver sulphide, chloride, and antimonide; native silver occurring in grains, scales and twigs, frequently incrusting, the talc appearing sometimes to be interlaminated with scale silver. Assays from 30 to 23,600 ounces silver to the ton are reported. The ore bodies vary from 1 to 13 feet in thickness. Three adits, 15, 30, and 80 feet in length, with two winzes and two drifts, show up the ore bodies. Two shipments have been made, one of half a ton returning 120 ounces silver to the ton, another of 8 tons returning 67 ounces silver to the ton; another lot of about 12 tons is on the dump awaiting transportation. About 100 tons of second-class ore, assaying 40 ounces, are on the dumps.

On the easterly slope of the lime belt are situated:

The Globe, with a vein of northerly and southerly strike, perpendicular dip, and 20 feet in width, with ore 4 feet in thickness, assaying 171 ounces silver to the ton; 25 feet of development work have been placed on this lode.

The Idaho is worked by an adit 30 feet in length, showing a vein 2 feet in thickness, of talc and quartz carrying iron and copper sulphides, galena, and silver; assays 76 ounces to the ton.

In the central part of Polomas mining district is a belt of copper shales, greatly tilted and contorted, where recently an important discovery of copper ores has been made.

In a description like the foregoing all the locations or partially-developed properties cannot be specially noticed, and there are others that doubtless may become producers.

The *Pittsburgh* and *Christobal districts*.—These are two adjoining districts lying east of the Rio Grande, in this county, in the Sierra Caballos and Christobal Mountains. The region is regarded as especially rich in copper and lead carrying silver, but it has as yet been only partially prospected, and very little development has been done.

The following description is from the pen of D. J. M. A. Jewett, esq., a prominent civil and mining engineer of New Mexico, to whom I am also indebted for the accompanying map of this mineral section:

The mining camp in the Christobal Range contains several prospects of rather unusual promise. No work has been done there for some time in consequence of the mines being on territory disputed between the miners and the owners of the Pedro, Armendariz grant No. 33. The west line of this grant was in 1872, either by gross error or fraud, located 2½ miles west of its position in the field-notes. Steps have been taken to correct this. Meanwhile the mining interests of the range have been compelled to suspend active operations.

The Pittsburgh mining district in the north end of the Caballos Range is based mainly upon two great copper lodes, one east and west nearly, upon which lie the Stilsel, Pittsburgh (from which the lode and camp are named), Wellington, and Keystone (all the property of Capt. Josiah Arnold, of Portage, Wis.). The Stilsel and Pittsburgh are old Mexican mines, from which were rudely extracted several hundred tons of very rich ores. These were smelted in mud smelters, 1½ miles west, upon the bank of the Rio Grande.

On the north and south lode and its spurs are located the Garibaldi, Thames, Marion, Rebecca, Bonita, Indian Monarch, Mongolian, Australian, Egyptian, Assyrian, Persian, Abysinian, Dixon, Milwaukee, Hillsborough, Ida, Cora, and other claims. The three last named are also old Mexican mines, and have yielded large amounts of ore.

The east and west lode is a contact. Foot wall, white and red micaceous granite; hanging wall, lime. The north and south lode is a fissure in granite, capped with lime and traps. Both are upon the west flank of the range, which is itself of the lower carboniferous period. On the east side and in the north end of the range is abundant coal of fine coking quality. Two miles north of the Hillsborough location is a deposit of a fine quality of iron ore, very suitable for fluxing. None of the locations are more than 3½ miles from the Rio Grande. No better situation and surroundings can be conceived of for profitable mines. The ores are red and black oxides, mainly massive, with tetrahedrite, chalcopyrites, erubescite, azurite, malachite, and glance in inferior and varying proportions. Most of the ores are accompanied by the oxides of iron in sufficient proportions to vastly facilitate the smelting operation. No development work has been done here since the beginning of the fiscal year, except the sinking of a 100-foot shaft upon the Pittsburgh. Captain Arnold, the heaviest owner, has preferred to defer extensive work until after obtaining patents for his properties. Having accomplished this, extensive development may be expected shortly. Neither this nor the Christobal district has any product to report for the year.

The accompanying map illustrates the special advantages these districts enjoy in their surroundings better than many pages of letter-press could do.

The *Iron Reef district.*—This district lies some 6 miles south of Cuchillo and west of the Rio Grande. It was only discovered in the latter portion of the year, and is in consequence only slightly prospected, and but little development work has been done. The formation of the district is limestone, shale, gray gneiss, and pink and gray schist, the mineral occurring in the limestone in the form of a crystalline chloride or sulphide. The veins are generally covered with an iron and copper cap, and yield from 40 to 60 ounces of silver to the ton. The rich pay ore is, however, in the form above described, from which an average of 4,000 ounces to the ton has been had in seven separate assays. Picked specimens are reported to have given as high as 10,000 ounces to the ton.

The Equator lode is the only location upon which work has thus far been done, and it was from this prospect that the above assays were obtained. East of this the Iron Reef and on the south the Jague have been located. From neither has the copper and iron cap yet been removed, but the surface indications show them to be equally rich prospects. Aside from these many other locations have been made.

*Cuchillo Negro district* lies to the east of Polomas and Apache districts. It is an extensive mineral belt, containing several hundred locations. Its ores are low grade, but being rich in galena and carbonates of both copper and lead are valuable for fluxing. Reports of operations during the year are exceedingly meager, brief accounts of the Black Knife, Guide, and operations of the Humboldt Mining Company only having been received. The shaft of the former shows about 3 feet of good mineral, and an incline 4 by 6 feet is sunk in solid ore, 3 feet of which is superior to any yet exposed.

In the Guide a new ore body has been uncovered—the third in the course of development. The vein is vertical and in porphyry entirely outside the contact. The pay streak is 18 inches in width and the mineral is said to be fine-looking. No assays are given.

The Humboldt Company have been pushing work upon the Little Luella and their other properties in this district. Nine men are now employed upon the Luella, the tunnel of which is reported to have cut a ledge of quartz 5 feet thick. A shaft from the bottom of the tunnel is down upwards of 40 feet, all in vein matter, said to contain rich mineral throughout.

*Apache* or *Chloride district.*—This district is almost immediately north of Palomas, and in the very center of the Black Range mineral belt. The Silver Monument, Buffum, Colossal, and King No. 2 are among the best mines of the district in point of development.

The shaft of the Silver Monument has been sunk to a depth of over 150 feet, and in addition has been developed by a tunnel of considerable length. All the workings are thoroughly timbered, a protection which neglected in the earlier stages of development subsequently occasioned much trouble. The vein of this mine is reported to be about 8 feet wide with a 10-inch pay streak on one wall and 4 feet of ore on the other, with a 3-foot deposit of mineralized talc in the center. The first shipment of ore gave mill returns of $140 in silver to the ton; the second, about 10 tons in quantity, gave $240 to the ton, and the ore now upon the dump, ready for shipment, is expected to assay much higher. This is regarded as one of the best mines of the Black Range, but its thorough development has been somewhat postponed by difficulties between the owners and lessee, which are now said to be in a fair way of adjustment. About ten men are kept employed in the various workings of the mine.

The Buffum is opened by a shaft to a depth of about 230 feet, the whole of which is thoroughly timbered from top to bottom. The mineral shows well throughout its entire depth, and gives assays of $225 in silver and a value of $50 in copper to the ton. One shipment gave mill returns of 100 ounces of silver to the ton. In addition to the above development, drifts on the vein to the north and south have latterly been run.

The Colossal.—Work on this mine has progressed during the year, but at the present time so much water has been encountered in the shaft that but little more can be done until pumping machinery is supplied. A tunnel is being driven in on the vein, from which fine ore is being obtained. The shaft is being enlarged, with a view to preparing it for compartments; in the prosecution of this work some good ore is being removed.

The King No. 2 is being worked under bond, and is producing some rich black sulphuret ore. The streak is not wide.

The King, Adirondack, Wall Street Nos. 1 and 2, Chieftain, Apache, Blackhawk, White Signal, Topeka, Omega, Excelsior, Midnight, and Hermosa are all locations more or less developed.

Assays from the Apache show a value of nearly $670 to the ton in silver and gold. The Ivanhoe is also located in this district, and is represented to be producing good ore, bearing both gold and silver. The gold in fair quantity can be obtained by crushing the ore and the silver by smelting it.

Placer discoveries which may prove valuable have recently been made on the Upper Cuchillo Negro, not far from Chloride. The first prospector in this section heard fabulous stories from the Mexicans of precious nuggets found on this creek, but the rich lode discoveries attracted greatest attention and the placers were neglected. The wash of the bars of the stream is said to be exactly of the desired character. In prospecting every pan of dirt washed is reported to contain from two to seven colors in heavy gold. Quite a number of locations have already been made, it is said, with the intention of commencing work upon them as soon as practicable.

*Socorro district*, lying in the Socorro Mountain, a few miles west of the town of Socorro, is the best prospected and developed in the entire county. Its principal mines are the Merritt, Torrence, Morning Star, Socorro Tunnel, Reserve, Santa Teresa, Induvigen, and Cabinet.

The Merritt is an old Spanish mine, having been worked over two hundred years ago in the rude gopher style of the time. It is now systematically opened by two main tunnels—one of about 175, the other of 130 feet in length, on an ore body that ranges from 4 to 15 feet in width. In addition it is developed by several shafts and smaller tunnels to an aggregate extent of about 700 feet, all on the vein and in good paying ore. The output is reported at from 20 to 30 tons of good paying free-milling ore, all of which is treated by the ten-stamp mill located at Socorro.

The Torrence mine, perhaps the next in point of importance, has already been described in my reports, and nothing new has been received during the year. An idea of its extent may be obtained from the output of ore since its location, which is reported to be upwards of $175,000 in value. The mill at Socorro referred to was built by the owners of this property.

The Cabinet is comparatively a new development. The main shaft has been sunk to a depth of about 200 feet. The vein or ore body is said to be large and a true fissure, which, although no cross-cut has been driven, is reported to be about 50 feet in width of ore that will assay from 20 to nearly 200 ounces to the ton in silver.

The Reserve mine adjoins the Torrence on the north end. It is opened by a shaft to a depth of over 200 feet, and is producing a fine grade of silver, a considerable quantity of which is a rich horn. The vein is about 4 feet in width.

The Morning Star is developed by a shaft to upwards of 100 feet in depth, showing a 4-foot vein. A considerable quantity of ore has already been taken out, and contracts have been made to continue the development extensively.

North of this district, about 6 miles, in the same range of mountains, is the Limitar Camp, in which a number of locations and considerable development have been made in the past. The same is true of Polvedero Camp, also near the river, and some 4 or 5 miles to the north of Limitar. Some fine discoveries were reported several years ago, but since nothing new has been received from them. Northwest of the latter place, in the Ladrone Mountains, rich strikes of both gold and copper ores are reported. Upon one property, the Blue mine, in this new camp, about 40 feet of development in the way of a shaft has been made, showing a vein about 12 inches in width of good looking mineral.

The Minerva is a prospect upon which the little work done has developed a vein said to be at least 10 feet in width, the surface croppings of which have given assays of $220 to the ton in silver.

*Magdalena district.*—This district lies some 25 miles westward from Socorro, in the Magdalena range of mountains. It embraces an extensive area, in which the ores are of low grade, with a few exceptions, but immense bodies of almost inexhaustible galena and carbonate deposits have been opened up. The reports of the year's operations on the various properties of this district refer generally to new discoveries and strikes.

The Kelly mine is, so far as present development can demonstrate, the most important mine in the Magdalenas. Its ore is a low-grade carbonate carrying galena and an average of about 12 ounces in silver to the ton and 35 per cent. and upwards in lead. The mine has now, it is stated, nearly 4,000 feet of tunnels, levels, shafts, drifts, &c., and nearly 100,000 tons of ore are in sight in the various workings. The cost of mining is but a trifle, owing to the peculiar occurrence of the ore bodies and the favorable physical surroundings; over 100 tons daily can easily be produced, and this quantity can be largely increased when desired. Seventy men are employed in the mine. It is reported that two hundred teams are now engaged in transporting the output of the Kelly to Socorro, where it is treated. This ore also contains considerable carbonate of lime and fine specular iron, which give it an additional value as a fluxing agent. The mine was purchased early in the year by the proprietor of the smelter at Socorro because of these peculiar properties of its ores. This smelter has been greatly enlarged during the year by the addition of another stack, and the erection of a third is under contemplation. Its present capacity is about 120 tons per day, and will be 160 to 175 when the plant is finally completed.

The following-named mines are some of the newer developments of the district, which are reported to be yielding high-grade ores, viz: Pinon, Pinon Extension Guiterez, New Mexican, Slaven Extension, Eighty-one, March Extension, Midnight, Early Dawn, Pueblo Spring, Hardscrabble, Juanita, Lookout, Silver Peg, Kniles, and Oro de Mesa.

The Pueblo Spring is developed by shaft to a depth of 48 feet, where the vein is shown to have a width of about 8 feet. The ore, an argentiferous galena, is reported to yield 100 ounces of silver and about 50 per cent. of lead to the ton.

The Pinon and Extension have been opened by a 25-foot shaft at the intersection of the two claims, which is reported to have uncovered a vein showing a 4-foot pay streak of gray copper ore, which assayed from 50 to 500 ounces in silver to the ton. In addition about 100 feet of surface development have been done on this claim.

The Guiterez mine and Extension are also good locations, which have been considerably worked. A shipment of 100 sacks of its ore to the Billing's smelter, Socorro, is reported to have run 330 ounces in silver to the ton, and the last few feet of work done has resulted in the removal of still richer ore, some of which is represented to be worth $1,000 to the ton. These properties are intersected at the south end by the Ratler lode, upon which also is located the New Mexican, reported to be a valuable property, yielding in silver from 50 to 5,000 ounces to the ton.

The Slaven Extension has a 60-foot shaft down on the vein, the width of which has not yet been determined. The ore is a galena and carbonate, and is said to yield over 60 per cent. of lead.

The March Extension is said to produce ore that carries from 100 to 500 ounces of silver. No details as to development or size of vein are given.

The Midnight and Early Dawn are said to be locations on a wide lode, which yields from 30 to 600 ounces of silver to the ton.

Besides the silver, copper, and lead the ores from most of these mines also carry gold in greater or less quantities.

The Hardscrabble is another important mine in this camp, upon which a great deal of work has been done. It has recently been furnished with steam-hoisting and pumping machinery, which had been purchased for the Iron Mask, also a fine property of this section.

Juanita.—This mine has been opened by tunnels, drifts, &c., to the extent of about 1,200 feet of work, and is supplied with cars, tramway, and other necessary appliances for the removal of its ores, of which it is reported to be able to furnish 100 tons daily. The ore is a sand carbonate.

The Lookout is opened by a 30-foot tunnel, from which ore has been taken, which is said to resemble that of the Sierras at Lake Valley. Samples have given 500 ounces silver to the ton.

The Kniles mine is an important prospect. It has been developed by a cross-cut tunnel 60 feet in length, which at a depth of 40 feet is reported to have cut a 15-foot vein of carbonates, carrying iron and galena, and giving assays of from $50 to $350 in silver to the ton. From the cross-cut a shaft, 5 by 6 feet in dimensions, has been sunk on the vein, all in ore of various grades, some of which is high grade.

The Silver Peg group and Oro de Mesa are also reported to be good prospects. On the former a 2-foot vein of high-grade carbonates was uncovered at a depth of 4 feet from the surface.

The Oro de Mesa has a 16-inch vein of quartz-bearing gold, from which assays as high as $1,200 to the ton have been had.

*Pueblo district.*—West of the Magdalenas, about 8 miles, lies this district, in which considerable development has been done, but from which no reports of the year's operations have been received, except in the case of the Carnero mine. Upwards of 200 feet of underground work has been done on this property in the way of shaft and levels. It has already produced considerable ore, two car-loads having been recently shipped, and it is intended to make regular shipments to Socorro as soon as work has been resumed.

*Gallmas district.*—Still farther to the west, and about 45 miles from Socorro, is the district of this name, but nothing is known of the development that has been made in it during the year.

*Mogollon district* lies in the Mogollon and San Francisco mountains, in the extreme southwestern portion of the county. In this district the Cooney or Silver Hill mine has been an active producer during the year, and is the only one that is reported as having had any output of ore. A number of other locations in the camp have been worked more, however, in the way of development than with a view to an output.

The Alma mill, of five-stamp capacity, has been running on ore from the Silver Hill. This mill is reported to be entirely inadequate to the wants of the district, which may account for the tardy development of the other known promising properties, as the cost of shipping ore from this remote camp is so great as to make it impossible to do so profitably, except in the case of ore of unusually high grade. The production of the mill is reported to have been $29.250 for the year.

The production of the county during the year 1883 was $400,000 in silver, and $6,000 in gold.

## TAOS COUNTY.

The following in relation to this county was furnished by Mr. A. Gusdorf, of Taos:

The development of the mines in Taos County has not progressed as rapidly as the character of their surface indications would justify, chiefly on account of a lack of capital and dissensions among the members of some of the companies.

*Picuras district* is about 20 miles south of Fernandez de Taos, and its mineral deposits received considerable attention during 1883. The De Soto mine is now opened to a depth of 250 feet, and has about 75 tons of good copper ore on the dump.

Anderson Brothers own several claims, of which the Champion No. 1 and No. 2, Ruby, Coppervine, and Royal Purple are the most promising; all have been opened from 40 to 80 feet in depth, and have about 200 tons of ore carrying copper, with some gold, on the dump.

M. Raily & Co. own several lodes. On the Missouri is a tunnel 250 feet in length, and on the Wilson a shaft 60 feet in depth; in each a fair body of copper ore is exposed.

The Pearl and Orange City are prominent claims owned by A. C. Anderson.

The little Utah, owned by Ross and Gusdorf, is down 30 feet; the ore assays 81 ounces of silver to the ton and 42 per cent. of copper.

Messrs. Anderson and Ringe have erected a 2-ton smelter and made two trial runs, but although they obtained a fair yield of copper for the amount of ore smelted, yet the operations were not entirely satisisfactory. It is expected that it will be again started in 1884.

*Arroyo Hondo district* is about 15 miles south of Taos. The Dora Newall is the principal mine; it shows a good body of ore, which could be extracted and shipped at a profit; no work was done during the year, owing to misunderstandings between members of the company.

McGregor & Lane did considerable work on their properties, the Lima and Evening Star. On the former a tunnel was run 100 feet and on the latter a shaft was sunk to the depth of 70 feet.

Gillmore, Doss & Drake are actively engaged in opening the Baltimore and Belfast lodes, and expect to have the latter down 200 feet by the spring of 1884. The vein carries galena.

The Schistoss Tunnel claim and Picuris No. 1 and No. 2, which were formerly owned by the Picuris Mining Company, are now the property of A. Gusdorf. The tunnel is in 240 feet and will soon cut the Picuris No. 1, which at a depth of 20 feet yields ore that assays 83 ounces of silver per ton and 20 per cent. of lead; the tunnel will strike the vein at a vertical depth of 250 feet.

The Lion, owned by Allen, Doss & Ringe, shows a fine body of galena at a depth of 40 feet.

The Telegraph Boy, owned by Smith & Score, is also worthy of mention.

"In *Rio Hondo district*, 12 miles north of Taos, much work was done.

"Frazer & Co. own several claims which exhibit large bodies of ore and considerable has been taken out and is now on the dumps. They are erecting a smelter, which it is expected will be in operation early in the spring of 1884, as all the machinery is on the ground.

"W. E. Craig is the owner of promising claims which he is opening with a force of about twenty men.

"Anderson Brothers have seven claims, on one of which a tunnel is being run; it is now 360 feet in length, and opens a body of free-milling gold-bearing ore which assays well.

"Doss, Allen & Co. own the Cash lode, also gold-bearing,

"In *Rio Colorado district*, 30 miles north of Taos, a number of copper ledges are located, the chief of which are owned by a Chicago company of which Dr. White is manager. A tunnel 400 feet in length has been run, exposing a fine body of ore. The company expect to erect machinery in the spring for reducing their ores, a large quantity of which is now on the dumps."

The production of this county during the year 1883 was $15,000 in gold.

# CHAPTER X.

## OREGON.

Although several reliable correspondents have furnished detailed information in regard to the production of the mines in their respective localities, the returns as to the whole State are incomplete, and the amount of gold and silver produced in some of the counties can only be given approximately. As is usually the case where placers are the principal source from which the precious metals are obtained, the yield of the mines has continued to decline. The mints and assay offices report, of unrefined bullion received from this State, $463,286 gold, being $120,000 less than the deposits of similar bullion during the previous year. Adding to this $200,000 as the proportion for Oregon of the ten millions of refined bullion deposited at the San Francisco mint, and sent to private refineries, would make its production for 1883, in gold, $660,000. The deposits of silver in 1883 credited to the State amounted to $5,248. Wells, Fargo & Co. report as having carried by their express out of the State, $11,690 silver, and $387,927 gold. As the gold bullion contained some silver, it is probable that the production of silver was not less than $20,000.

The bullion produced in the *Rye Valley district* is worth only about $12 per ounce, and in other localities not over $5 or $6 per ounce, owing to the presence of silver; and occasionally the gold dust obtained from the placers is alloyed with silver so as to reduce its value to $9 or $10 per ounce. The facilities for the treatment of sulphuret ores have not been provided by any of the mills, and the product of many of the ores is far below the assay value. Thirty stamp mills have been erected and are in operation, besides several arrastras. There was great complaint during 1883 of the lack of water for working both hydraulic and placer mines. In the northeastern part of the State, in Baker and Union Counties, considerable quartz mining is carried on. In the same portion of the State are large and remunerative deposits of gravel, from which gold is obtained by the use of hydraulics, and ditches have been constructed a few miles in length, each carrying from 200 to 500 inches of water. There are several ditches in the State of considerable length, ranging from 10 to 60 miles, and supplied from the melting snows on the mountains, which, in Eastern Oregon, are not of sufficient altitude to maintain permanent streams during the summer; some of these ditches are capable of carrying 2,500 miners' inches of water, but nearly all of them run dry during the summer.

The production of Oregon, by counties, is approximately as follows:

| Counties. | Gold. | Silver. | Total. |
|---|---|---|---|
| Baker | $160,000 | $2,500 | $162,500 |
| Benton | 5,000 | | 5,000 |
| Coos | 20,000 | | 20,000 |
| Curry | 20,000 | 200 | 20,200 |
| Grant | 200,000 | 15,000 | 215,000 |
| Jackson | 100,000 | 1,000 | 101,000 |
| Josephine | 110,000 | 1,000 | 111,000 |
| Union | 45,000 | 300 | 45,300 |
| Total | 660,000 | 20,000 | 680,000 |

## BAKER COUNTY.

This is a southeastern county of Oregon, adjoining Idaho, and a portion of its gold product goes to the Boisé assay office. The county is over 160 miles in length from north to south and 50 miles in width, and gold hitherto has been found chiefly in the northern and central portion of the county, both in placer fields and quartz veins. While considerable gold is extracted from quartz mines the larger part of the product of the county has been obtained from the placers; $42,542 deposited at the Boisé assay office and credited to Idaho, was probably sent from this part of Oregon. The placers are found in the vicinity of Snake River or several of its principal tributaries; among the most noted in the past have been the Powder, Burnt, and Malheur Rivers, which rise in mountain ranges west of Baker County and by irregular and winding courses flow eastward to the Snake.

Although placer mining is continued, the amount obtained is yearly falling off. From the scattered situation of the mines and the small amounts produced by each, but which, however, aggregate a considerable sum, it has been difficult to ascertain the production of the county. A San Francisco paper published in November last a statement that in a previous week over $100,000 in gold dust and bullion had been shipped from Baker City, Oreg., the output of several mines in Baker County. This would be no indication of a weekly yield of the mines during the year. Whatever was shipped at that time was the result, doubtless, of the clean-ups of the mines at the close of a season's operations, and might be considered as nearly the total yield during the year of the mines in the vicinity of Baker City. However, prior shipments of gold have also been reported from time to time, and on reviewing the probable yield of this county I placed the amount at $160,000.

Among other interesting communications valuable statements have been received from Messrs. J. S. Locke and Hiram Colt. Mr. Locke, superintendent of the Rye Valley Placer Company, reports that, for lack of water, the season for mining was the shortest in nineteen years and the production correspondingly reduced. That company obtained 1,050 ounces of gold, being about 300 less than in the previous year.

*Mineral district.*—A correspondent of the Bedrock Democrat says that but little confidence was had at first in the results of the mines of this district, but that lately capitalists have invested money to develop them. As yet the results of their investments has not been made known.

*Humboldt mining district.*—The unusual scarcity of water reduced the yield from the placer district at least one-fourth. Mr. Hiram Colt says that during a twenty years' residence in the district he has never known a season with such a lack of water. He could obtain for his claims sufficient only for five days' full run and the other mines in the vicinity had the same experience. The area covered by the placers is extensive and rich, but the supply of water limited. No new mines worth mentioning were discovered or developed. He reports the placer gold to be from 783 to 863 fine, containing more or less silver. Mr. Colt reports or estimates the ounces of gold and silver produced by several mining companies in the district in 1883, which make an aggregate value of over $35,000 gold and $200 silver.

*Chicken Creek district.*—The placer mines of this district are worked by hydraulics supplied with water by a ditch owned by Mr. A. J. Weatherby, who estimates these placers to have yielded $10,000 in gold, and that $2,000 more was extracted from small quartz veins, the ores from which were reduced by arrastras with satisfactory results.

Mr. D. Carn, of Baker City, enumerates several districts and gives the value of their production, which, not being stated for the year, is omitted. He says Parker's is the western end of an old claim that lies under the base of the Blue Mountains, which range southeast by northwest. Wherever water could be obtained on this claim it has been worked with success. The facilities for working these mines, as regards timber, water, and dumping ground, are good, and cannot conflict with any agricultural interest.

## COOS AND CURRY COUNTIES.

Mr. J. A. Dean, editor of the Coquille City Herald, writes me that there are hundreds engaged in mining in this section. None of the pay dirt is very rich anywhere, but returns fair wages from $2 to $10 per day to the man. It is very difficult to ascertain what the numerous small mines are producing, but he reports the product of one of the larger mines, the Pioneer Black Sand, at $18,600.

Mr. Frank A. Stewart, of Port Orford, makes the following report as to mining in Curry County:

| Locality. | Gold. | Silver. | Total. |
|---|---|---|---|
| Gold Beach | $1, 000 | $5 | $1, 005 |
| Ophir Beach | 10, 000 | 50 | 10, 050 |
| Eucre Beach | 5, 000 | 25 | 5, 025 |
| Blanco Beach | 4, 000 | 20 | 4, 020 |
| Rogue River Bars (placers) | 2, 500 | | 2, 500 |
| Sixes River Bars (placers) | 4, 000 | | 4, 000 |
| Total | 26, 500 | 100 | 26, 600 |

In this report he says of the yield of the mines of Southern Oregon in this county:

"You will observe a marked increase in the amount of gold taken from the mines in this county during the past year. I could not obtain exact figures, but the above is rather below than above the aggregate.

"This county has numerous ledges of gold, silver, copper, and in fact every mineral known to the West, but its isolated condition and lack of capital have kept back their development. Silver is obtained in the river gold as in the beach gold, but I do not know its proportion, and hence did not report it."

## GRANT COUNTY.

Grant County, one of the largest counties of Oregon, in the southeastern part of the State, adjoining and west of Baker County, extends 170 miles north and south, and about 75 miles in width. The principal mines are on the headwaters and upper part of the John Day River, which has its source near the eastern boundary and in the northern part of the county, flows westward, then to the north, and empties into the Columbia about 30 miles east of The Dalles.

Mr. Phil. Metschan, of Canyon City, forwards a report in regard to the production from the mines of the *John Day* and *Elk Creek districts*. These reports, he states, are altogether the yield of placer mines, which production is decreasing steadily each year, and is mostly under the control of the Chinese, on account of which it is very difficult to obtain correct figures. Prospecting for quartz continues. A company, consisting of Messrs. Whitman, Thompson, and Muldrick, are running a tunnel in the mountain south of Marysville, where they expect to strike some rich mines.

The total production of John Day mining district is stated by Mr. Metschan to have been as follows:

| | |
|---|---|
| On Canyon Creek: | |
| Humboldt Mining Company | $12,196 |
| Wolfinger & Co | 10,000 |
| One hundred Chinamen, various locations | 50,000 |
| Marysville district | 15,000 |
| Elk Creek district | 25,000 |
| Total | 112,196 |

South of the upper end of John Day Valley rises a high and rugged chain of mountains which exhibits evidences of fierce volcanic activity throughout its entire length. Ancient craters are found incased in precipitous walls and hundreds of feet in depth are found in this chain of mountains. This range, although apparently elevated at a later period than the surrounding region, is much higher than the adjacent mountains; it terminates at Canyon Creek, and the western end is known as Canyon Mountain, which overlooks the greater part of Grant County. The mountain is about 8,000 feet above the level of the sea, and rises some 5,000 feet above the John Day Valley, which from its summit appears like a huge trough hewed out of the surrounding highlands. Granite Creek lies far to the northeast, beyond the high peaks, which obstruct the view.

*Granite district.*—Mr. Johnson, of Granite, sends a report of the production of this district, of which he says the main part of the production is by Chinamen and is estimated, but the production by the white population is correct. "Most of the mines worked by white miners are hydraulic mines, and are worked, or are capable of being worked, on an extensive scale.

"Johnson & Klapp's mine is an extensive deposit of gravel, worked by a giant with about 1,200 inches of water.

"Odell & Gardner's mine is also quite extensive. The gravel is well washed and very brittle, everything being broken up and run through the flumes.

"The claim of Tabor & Co. is a series of benches about 20 feet in depth and carrying gold from top to bottom. They have about 60 acres, of which a very small part has been worked.

"Many Chinamen are at work, but it is difficult to find out exactly how much they produce. Cong Wing Chong, a Chinese company, have an extensive bar on Granite Creek, which they work with varying success.

"There are many quartz lodes in this district, but for want of capital nothing but assessment work is being done."

*Dixie Creek.*—Dixie Creek, famous for its placer mines in former years, now has little to show except deserted or decaying cabins as evidence of its early remunerative mines. The prospectors following up Dixie Creek from its mouth at Prairie City, where it unites with the John Day River, soon after the commencement of mining in this region, discovered in the gulches at the headwaters of the creek quartz veins which had supplied the gold found in the placers below. The latter were, however, so easily and more profitably worked that little attention was paid to the more permanent quartz deposits.

At the foot of Comer Gulch, and in the vicinity of the quartz lodes, is located the little town of Quartzburg. Among the most important locations in this region are the Wide West and the Keystone, belonging to the same company. The latter has been steadily worked during the season and from it over 500 tons of ore extracted, which was crushed in the company's arrastra, which averaged, as is claimed, $40 in gold to the ton. The ore contains free gold, sulphurets, silver, and a small quantity of galena, and assays have been made showing $106 to the ton in gold and from $100 to $1,000 in silver. None of the latter is saved by the present method of working. The vein is 4½ feet in width, between well-defined granite walls. The cost per ton of extracting and treating the ore is, for mining, $5; hauling, $1.25; crushing, $2.25. Seven men are employed, and the arrastras in midsummer were run night and day, grinding out over $200 per week, and in July were reported to have cleaned up $14,000.

*Olive Creek.*—Mr. C. W. Daggett, of Robinsonville, estimates that 1,555 ounces of gold of the value of $25,000 were obtained from the gold fields in this district.

Mr. J. W. Waterman, of Camp Watson, reports that but two mines are operated at that place, but that he is unable to give their production, which is probably very small.

## JOSEPHINE COUNTY.

Several new mines have been opened and developed in the mining districts of this county, the principal ones being in the *Waldo* and *Althouse districts.* The season for placer mining was short, in consequence of the lack of water, and many of the mines that paid well during the previous season were forced to suspend operations and lie idle. Considerable mining has been done by Chinamen in this county during the past season, and while it is difficult to obtain reliable information of the amount produced by them, it has been estimated by Mr. John Hodgdon that about $12,000 was taken out by them. This amount was principally produced from the *Althouse district.* In this district some forty white men are also reported by him to have taken out about $8,000.

The Waldo Hydraulic Mining Company in the *Waldo district*, is reported by Mr. W. J. Wimer to have produced about $14,800. About 1,400 feet of new pipe has been added to this mine this season.

The Bybee & Newman mine has produced about the same amount of bullion as it did last year.

In the Simmons and Ennis mine improvements to the extent of $50,000 have been made. The main cut is to be extended through to the Caron and French Flats, but will not reach pay dirt from three to five years; the cut will be 100 feet deep. The water-ditch is 10 feet in the clear, and the main cut will be 3 miles in length, and extends through timber and rocky land; the grade is about 1½ inches to every 12 feet. The head of this claim is situated about half a mile from Waldo. The company is employing fifty men. The production of this mine is not stated.

The Skeeler and Walker mine is located 2 miles east of Waldo, on what is called "Hogue Hill." A new giant has recently been shipped to this mine.

In regard to the mines of the *Waldo mining district* Mr. Wimer, of Waldo, states that their production was about the same in amount as in the previous year. The amount produced by the Waldo Hydraulic Company during 1883, he says, was $14,600 gold and $200 silver.

Mr. F. M. Nickerson, of Kerby, gives the following synopsis of the mines of the various districts:

| | |
|---|---|
| Waldo | $3,000 |
| Althouse | 25,000 |
| Kerby | 6,000 |
| Galice Creek | 8,000 |
| Williams Creek | 3,000 |
| Grave Creek | 20,000 |
| Total | 65,000 |

A company in *Althouse district*, composed of John Swan and others, prospecting what is known as the Big Slide, obtained as high as $5 to the pan at the upper end of the slide, and during the latter part of the season were running an incline at the lower end, feeling sanguine of being well paid for their labor.

# CHAPTER XI.

## UTAH.

Utah shows a decline of over a million of dollars from the yield of gold and silver in 1882. The falling off has not been confined to any section, but has occurred in all parts of the Territory and in nearly all the principal mines. Operations, however, have not been without profit, as dividends were paid to the amount of $1,582,000, as follows:

| Mines. | Dividends. | Amount. |
|---|---|---|
| Christy | 2 | $12, 000 |
| Crescent | 2 | 120, 000 |
| Cosmopolitan | 1 | 50, 000 |
| Horn Silver | 4 | 1, 100, 000 |
| Ontario | 4 | 300, 000 |
| Total | 13 | 1, 582, 000 |

The yield of the Territory, according to Wells, Fargo & Co.'s statement for 1883, was as follows:

| Description. | Lead refined. | Lead unrefined. | Silver. | Gold. |
|---|---|---|---|---|
| BASE BULLION. | *Pounds.* | *Pounds.* | *Ounces.* | *Ounces.* |
| Frisco Milling and Smelting Company | ............ | 960, 921 | 44, 623 | 404 |
| Germania Lead Works | 3, 230, 547 | 2, 970, 000 | 289, 070 | 950 |
| Hanauer | ............ | 8, 764, 542 | 446, 784 | 1, 665 |
| Horn Silver Mining Company | ............ | 30, 112, 158 | 1, 103, 382 | ............ |
| Mingo Furnace Company | ............ | 11, 666, 400 | 285, 101 | 906 |
| Net product base bullion | 3 230, 547 | 54, 474, 021 | 2, 168, 960 | 3, 925 |
| Lead, silver, and gold in ores shipped | ............ | 8, 957, 943 | 140, 390 | 557 |
| Matte containing copper, 557,875 pounds | ............ | ............ | 41, 840 | 1, 115 |
| Total | 3, 230, 457 | 63, 431, 964 | 2, 351, 190 | 5, 597 |
| DORÉ BARS. | | | | |
| Ontario Silver Mining Company | ............ | ............ | 1, 700, 224 | ............ |
| Silver Reef District | ............ | ............ | 416, 505 | ............ |
| Tintic Mining and Milling Company | ............ | ............ | 49, 884 | 654 |
| Other mills and placers | ............ | ............ | 13, 960 | 740 |
| Total doré bars | ............ | ............ | 2, 180, 573 | 1, 394 |

### RECAPITULATION.

| | | |
|---|---|---|
| 3, 230, 547 | pounds refined lead, at 5 cents per pound | $161, 527 |
| 63, 431, 964 | pounds unrefined lead, at $50 per ton | 1, 585, 799 |
| 4, 531, 763 | ounces silver, at $1.10 per ounce | 4, 984, 939 |
| 6, 991 | ounces gold, at $20 per ounce | 139, 820 |
| | Total export value | 6, 872, 085 |

Computing the gold and silver at their value in U. S. coin and other metals at their value at the seaboard it would increase the value of the product to $8,000,000.

Their statements for 1882 and 1883 compare as follows:

| Year. | Gold. | Silver. |
|---|---|---|
| | *Ounces.* | *Ounces.* |
| 1882 | $9, 039 | 5, 435, 444 |
| 1883 | 6, 991 | 4, 531, 763 |
| Decrease | 2, 048 | 903, 681 |
| Amounting in value to | $40, 960 | $1, 168, 396 |

According to the statement for 1883 the value of the gold was $144,504, and of the silver (at its coining rate) $5,859,250, a total production of $6,003,754. From this, however, should be deducted the value of gold and silver contained in ores shipped into the Territory from other States and Territories, reported as follows:

| County. | Quantities. |
|---|---|
| | *Tons.* |
| Gunnison, Colorado | 1, 111 |
| Lake, Colorado | 837 |
| Oneida, Idaho | 50 |
| Alturas, Idaho | 1, 769 |
| Humboldt, Nevada | 108 |
| Lander, Nevada | 110 |
| Eureka, Nevada | 553 |
| Elko, Nevada | 55 |
| Lyon, Nevada | 11 |
| Total | 4, 604 |
| Worth about | $200, 000 |

Computing the silver at its standard dollar coining value, I estimate the production of Utah for the calendar year 1883, as approximately: Gold, $140,000; silver, $5,620,000; total, $5,760,000.

The following table shows the production of Utah during 1883, estimated by counties.

| County. | Gold. | Silver. | Total. |
|---|---|---|---|
| Beaver | $12, 000 | $1, 625, 000 | $1, 637, 000 |
| Juab | 40, 000 | 290, 000 | 330, 000 |
| Pi Ute | 5, 000 | 10, 000 | 15, 000 |
| Salt Lake | 80, 000 | 650, 000 | 730, 000 |
| Summit | | 2, 400, 000 | 2, 400, 000 |
| Tooele | 3, 000 | 45, 000 | 48, 000 |
| Washington | | 650, 000 | 650, 000 |
| Total | 140, 000 | 5, 670, 000 | 5, 810, 000 |

The shipments of bullion and ore from the Territory during 1883, over the Denver and Rio Grande and Utah Central, were as follows:

| | Pounds. |
|---|---|
| January | 5, 801, 766 |
| February | 4, 795, 385 |
| March | 4, 263, 177 |
| April | 4, 587, 533 |
| May | 5, 940, 304 |
| June | 5, 872, 623 |
| July | 7, 439, 900 |
| August | 8, 110, 660 |
| September | 8, 186, 284 |
| October | 7, 940, 863 |
| November | 9, 760, 242 |
| December | 9, 272, 386 |
| Total | 81, 971, 123 |

The bullion receipts at Salt Lake for 1883 are reported as follows:

| | Pounds. |
|---|---|
| January | 473,025.83 |
| February | 577,041.24 |
| March | 661,571.66 |
| April | 563,341.77 |
| May | 506,565.10 |
| June | 453,480.20 |
| July | 481,919.09 |
| August | 541,880.60 |
| September | 659,173.97 |
| October | 695,150.42 |
| November | 710,629.62 |
| December | 607,548.32 |
| Total | 6,931,327.82 |

This does not include ore from Nevada, Idaho, the Mingo, part of Silver Reef, and some other places.

The Salt Lake Tribune publishes an instructive statement of the expenditures made by mining enterprises in Utah during 1882. It does not, of course, include all the mills and mines, but nearly all the important ones will be found in the list below:

| | | | |
|---|---|---|---|
| Horn silver | $1,333,827 | Martin | $30,000 |
| Ontario | 978,012 | Yosemite | 50,000 |
| Mingo | 641,701 | H. Sebree | 20,000 |
| Germania | 772,160 | George A. Lowe | 15,000 |
| Hanauer | 378,714 | John W. Lowell | 25,000 |
| Frisco | 210,353 | Walker Bros | 100,000 |
| Christy | 245,255 | G. S. Erb | 145,000 |
| Stormont | 181,321 | Electric Light Company | 10,000 |
| Barbee & Walker | 109,743 | M. McKimmins | 35,000 |
| Park City smelter | 100,000 | Mulloy & Paul | 35,000 |
| Stewart | 75,000 | Sierra Nevada Lumber Company | 100,000 |
| Lowell | 50,000 | | |
| Tiernan | 25,000 | H. Wagener | 100,000 |
| Tintic | 100,000 | S. C. Ewing | 30,000 |
| Eclipse | 60,000 | Tribune Company | 75,000 |
| Conklin sampler | 35,000 | Auerbach Bros | 40,000 |
| Mackintosh sampler | 35,000 | Cohn Bros | 25,000 |
| Mammoth | 200,000 | Keyser & Moritz | 75,000 |

### SMELTING WORKS OF UTAH.

The Germania smelter is situated in South Cottonwood, 7 miles from Salt Lake City, on the Utah Central and Denver and Rio Grande Railroads. The works consist of four shafts and one reverberatory. The fumes are conducted from the shafts in tight iron flues, 6 by 3½ feet, to a large tight dust chamber, 25 by 35 feet wide, and thence by a flue 300 feet long to a stack 108 feet high. The four shafts have a daily capacity of 180 tons. Refining capacity, 40 tons.

The Germania Lead Works have recently built a large structure for the purpose of increasing their manufacturing facilities. The company purposes to resume refining bullion immediately, no work of that kind having been done at the works for at least a year past. Hereafter little crude bullion will be shipped east, as the company in doing its own refining and utilizing its lead can dispense with these shipments. The gold and silver will be sent to New York. The works have been producing 15 or 20 tons of bullion daily, aggregating about $2,000 in silver and gold and about $1,000 in refined lead. The company recently erected a fine sampling mill, where all sampling of ores brought from the different mines is done. There are no other works of this kind nearer than Omaha and San Francisco. The Germania works will be able to take the ore from the mines, sample, smelt, and refine it, and manufacture the lead into any article for which that metal is used. About one hundred men are employed, and when the additions are completed and the machinery erected there will be work for one hundred and fifty more. In the white-lead factory they use the process of granulating the lead by steam There are 42 cylinders, each capable of receiving a charge weighing 4,000 pounds.

Hanauer Smelting Works are about 2 miles north of the Germania, and have one shaft and two reverberating furnaces. The business of these works has increased during the year. In the two years past there were smelted as follows: 1882, lead, silver, and gold ores, 13,114,856 pounds net; 1883, lead, silver, and gold ores, 29,506,664 pounds net. Last summer a new 65-ton water jacket blast furnace was built. Among other improvements of the plant are a new 65-horse-power Leffet turbine water-wheel, with improved gear and tail-race tunnel under the slag dump; a 5½ Baker blower; a large Wilbraham rotary force-pump; an extensive system of heavy ore bins; changes and additions to the railroad switches, and the building of weirs, dams, and gates for the better control of the water supply. Coke is brought from Colorado and Pennsylvania; charcoal from Spanish Fork Canyon, Utah; iron ore from Tintic and Leadville; limestone from Salt Lake City, and ores from various sources. The bullion is shipped to Omaha via the Union Pacific Railroad. The ores and materials consumed at the Morgan smelter in 1883 were 1,419,790 pounds Pinyon charcoal; 7,941,557 pounds of coke; 29,506,664 pounds of dry silver, lead, and gold ores; 4,953,120 pounds of Tintic hematite; 13,275,170 pounds of limestone; 197 cords of roasting wood; 517 tons of coal, and 20 tons of metallic iron.

The Horn Silver Smelting Works, 1 mile north of the Germania, have five shaft furnaces and one reverberatory furnace; capacity, 250 tons daily.

The Park City Smelter, at Park City, Uintah district, consists of two shaft and reverberatory furnaces; capacity, 60 tons.

The Waterman Smelting Works, at Rush Lake, near Stockton, have two shaft furnaces, connected with a condensation chamber. One furnace has a diameter of 3 feet 4 inches; height from bottom of hearth to slag spout, 22 inches; to center of tuyeres, 32 inches; from tuyeres to charge door, 11 feet. There are four water tuyeres, with 3-inch nozzles. The furnaces are 9 feet high, and in size 30 by 40 inches in the hearth; above they are flattened to 4 by 4 feet.

Winnamuck Smelting Works, in Bingham Cañon, at the terminus of the Bingham Cañon Railroad, have reverberatory furnaces, a 60-horse-power steam engine and boiler, one No. 4 and two No. 5 rock blowers, eight roasting stalls, roasting kelns, and one dust chamber of iron.

Jordan Smelting Works, next to the Sheridan Hill Smelting Works, have five shaft and one reverberatory furnaces.

Mingo Smelting Works, at Sandy, on the Utah Central Railroad, have four shaft furnaces.

Flagstaff Smelting Works are at Sandy. They have four shaft and one reverberatory furnaces; water jacket furnaces are used.

Pascoe Smelter, at the northeast side of Salt Lake City, has one shaft furnace.

In *San Francisco district* are four smelting works—the Godbe, with two shaft furnaces; the Campbell and Cullen, with three shaft furnaces;

the Williams, with one shaft furnace; and Shauntie, with one shaft furnace.

In American Fork Cañon is the Sultana Smelter, with twenty charcoal kilns, owned by the Miller Mine and Smelting Company. This smelter has three shafts and a reverberatory furnace. The shaft furnaces are 9 feet above the tuyeres. The section of the hearth No. 1 is 20 by 36 inches. It has six water tuyeres, with 2½-inch nozzle. The size of Nos. 2 and 3 in the hearth is 24 by 32 inches. They have four tuyeres each. All the furnaces are provided with the automatic tap.

The Frisco Mining and Smelting Company's smelter has been idle this year.

The sampling mills of J. C. Conklin & Co. are the only works of the kind in Salt Lake. They are well located for handling ores cheaply and expeditiously. All the ores mined in Stockton, Ophir, and Dry Cañon, Utah, are sampled at these works, besides those from Nevada, Idaho, and Montana. The capacity is about 200 tons per day.

The Pioneer Sampling Mill at Sandy has complete facilities for handling ores, and its proximity to the smelters makes it convenient for business. Ores of Big and Little Cottonwood, Bingham, Butterfield, American Fork, Tintic, Wood River, Montana, and other districts have been during the past year handled and sampled at these works. The mill has kept busy, and the grade of ores has been fully up to that of any other year. The Pioneer Sampling Mill has all the modern improvements, and is conveniently arranged.

Park City Sampling Mill is 30 by 80 feet, and the main floor on which ores are sampled has the same area. In the southwest corner of the building is a room 8 by 10 feet, called the plate-room, which is used in grinding the ore to a pulp. Here, also, is a pair of scales, known as the moist scales, and other necessary appliances used by the operator in testing the water in the ore. On the main floor there is a grinder and crushers, also two platform scales and three trucks of 10 tons burden each, which can be conveniently moved from one part of the room to the other and out upon the platform to the cars. The platform is a strong and convenient one, being 10 by 80 feet, its length giving ample room to load two cars at once. The present capacity of the mill is 100 tons per day, and this can be readily increased. The engine-room, on the east end of the building, is 25 by 40 feet, and on the south side of this building a water-tank, with a capacity of 2,000 gallons, has been built. The supply of water is obtained from a well sunk for the purpose, which, though but 45 feet deep, contains 11 feet of clear, fresh water. The water is pumped into the tanks from the well by the engine. The engine and boiler are new, the former being 16-horse-power and the latter 30. An 8-ton Fairbanks scale has been put in, on which all of the ore hauled down for sampling must be weighed before being unloaded in the mill. The mill has been in operation little over a year. The ores sampled came from the Crescent, Sampson, Apex, Silver King, Roaring Lion, and some small claims.

Sandy Sampling Mill has been in existence nine years. Its capacity has been considerably enlarged and improved during the past year by the addition of new sheds, scales, &c., for the convenient handling of ores, and its business increased 50 per cent. over that of the year before.

## BEAVER COUNTY.

*San Francisco district.*—The mines of the San Francisco mining district are situated at the eastern base of the Grampian Mountains, the southernmost and lowest summits of the San Francisco Mountains, the high dividing ridge between Beaver Valley and the Wah Wah Valley. The veins in this locality are found between a hanging wall of trachyte and a foot wall of quartzite and dolomite, and are traceable along the entire base of the mountain for a distance of a mile and a half, in a course nearly north and south.

To the east of the mines, but a mile distant, the town of Frisco has been built on what is called an extinct crater, in which are still found volcanic ashes and scoriæ. The original location on this lode is the Horn Silver, and adjoining it to the northeast are several locations or extensions of the lode, the Carbonate, Cave, Comet, Morrison, New Haven, and Cactus.

The Horn Silver mine is owned by the Horn Silver Mining Company, incorporated under the laws of Utah, and, under the management of Harry Hill, has continued to be a large and profitable producer of silver bullion, although its product has fallen off over half a million of ounces from the previous year. It reports in 1883, 14,923 tons of lead and 1,133,209 ounces of silver. The ore has as yet been worked out only down to the third level, a depth of 150 feet, and a portion of the ore has been taken out between the third and fourth levels. From the fourth to the seventh level the cross-cuts show, according to published statements, an ore body averaging 70 feet in width. The main working (a double compartment) shaft is down 700 feet, and from this shaft drifts have been cut, each over 100 feet, westerly to the ledge. During the past twelve months from 100 to 150 tons of ore have been shipped daily from the Horn Silver to the company's smelters at Francklyn. The average assay value of the ore so shipped is said to be $60 per ton, and it has yielded in dividends, paid by the company, $20 per ton net profit. There are several qualities of ore, which are classified by letters, running from A to H. The ore varies from high-grade milling ore containing chloride silver to galena ore running 40 ounces. The ore is hoisted and run in cars from the shaft to bins, from which it is dumped through trap doors into the cars of the Utah Central Railroad, which connects the ore bins of the mine with the bins of the company's smelter at Francklyn.

From the published annual report of the manager of the Horn Silver Mining Company, made to the president and board of directors December 31, 1883, and kindly sent me by Frank G. Brown, the vice-president, I have extracted the following statements in regard to the monthly production of the mine, which, the report says, are complete and exact:

The Francklyn furnaces consumed the following tons of material:

| | |
|---|---|
| Horn silver ore | 41,040 |
| Ore bought | 462 |
| Frisco matte | 1,147 |
| Limestone | 22,263 |
| Iron ore | 12,251 |
| Morgan slag | 1,076 |
| Coke | 15,188 |
| Charcoal | 332 |
| Stone coal | 2,907 |
| Scrap-iron | 165 |
| Total | 96,831 |

Besides this they smelted 1,587 tons of slagged fume dust and 1,867 tons of their own roasted matte, and produced 15 tons of base bullion, assaying, on an average, 75.5 ounces of silver per ton. Among the disbursements were the following:

| | |
|---|---|
| For mining | $197,018 72 |
| Smelting at Francklyn | 571,804 92 |
| Freight on ores from Frisco to Francklyn | 235,380 70 |
| Ores purchased | 32,582 18 |
| On account of the Chicago refinery: | |
| Freight on bullion, less rebates | 275,461 82 |
| Fuel, &c | 122,939 26 |

The lead sales during the year amounted to $1,193,330.61, and the silver sales to $1,324,651.63.

The following dividends were paid by the company during the year:

| | |
|---|---|
| No. 8, February 15, 1883, 3 per cent | $300,000 |
| No. 9, May 15, 1883, 3 per cent | 300,000 |
| No. 10, August 15, 1883, 3 per cent | 300,000 |
| No. 11, November 15, 1883, 2 per cent | 200,000 |
| Total | 1,100,000 |

And the cash on hand at the close of the year was $31,872.59.

The loss in melting was as follows:

| Items. | Net lead. | Silver. |
|---|---|---|
| | *Pounds.* | *Ounces.* |
| There was on hand, January 1, 1883, in ores, matte, fume dust, &c | 3,048,892 | 105,786 |
| Horn silver ore received in 1883 contained | 29,596,285 | 1,117,854 |
| Frisco matte received in 1883 contained | 421,489 | 27,501 |
| Ores bought in 1883 contained | 292,695 | 25,557 |
| Total | 33,359,361 | 1,276,698 |
| Bullion shipped in 1883 contained | 29,940,086 | 1,133,215 |
| Should be on hand, December 31, 1883 | 3,419,275 | 143,483 |
| Stock-on-hand statement shows only | 1,558,479 | 142,669 |
| Showing a loss of | 1,860,796 | 814 |
| As the ore gone into the furnaces contained | 31,424,189 | 1,158,428 |

The percentage of loss is: For lead, 5.92 per cent.; for silver, 0.07 per cent.

*Sales of silver, New York, for year ending December* 31, 1883.

| Month. | Reported weight. | U. S. assay office weight. | Ounces produced, 999 fine. | Average per ounce received. | Gross amount received. |
|---|---|---|---|---|---|
| 1883. | *Ounces.* | *Ounces.* | | | |
| January | 184,250.00 | 184,346.20 | 180,739.84 | $1.092 | $202,233 93 |
| February | 85,185.25 | 85,233.20 | 83,270.98 | 1.109 | 94,232 93 |
| March | 162,269.50 | 162,348.80 | 159,916.02 | 1.109 | 178,917 91 |
| April | 103,339.00 | 103,419.50 | 101,494.65 | 1.105 | 114,270 24 |
| May | 80,364.00 | 80,398.00 | 78,948.01 | 1.100 | 88,427 75 |
| June | 63,535.75 | 63,574.60 | 62,309.57 | 1.108 | 70,540 83 |
| July | 74,047.75 | 74,078.00 | 72,598.60 | 1.106 | 82,378 32 |
| August | 94,398.00 | 94,438.40 | 92,646.98 | 1.104 | 104,758 55 |
| September | 66,163.00 | 66,205.00 | 64,875.46 | 1.110 | 73,562 66 |
| October | 84,791.50 | 84,812.00 | 83,091.21 | 1.111 | 94,713 36 |
| November | 90,238.25 | 90,284.00 | 88,419.39 | 1.106 | 100,191 41 |
| December | 98,712.25 | 98,767.60 | 96,913.42 | 1.107 | 108,544 72 |
| Total | 1,187,294.25 | 1,187,905.30 | 1,165,224.13 | 1.104 | 1,312,772 61 |
| January 11, 1883, proceeds sale in London: | | | | | |
| Bars 457–469 (1882 product)—11,678.50 ounces, at $1.083 | | | | | 12,654 12 |
| From railway company for one bar bullion lost, containing 2.585 ounces, at $1.12 | | | | | 2 90 |
| Total sales | | | | | 1,325,429 63 |
| Less commissions paid | | | | | 778 00 |
| Net amount of silver sales per financial statement | | | | | 1,324,651 63 |

*Ore smelted.*

| Month. | Ore smelted. | Assay. |  | Contents. |  | Smelting 1 ton ore. |
|---|---|---|---|---|---|---|
|  |  | Lead. | Silver. | Lead. | Silver. |  |
| 1883. | *Pounds.* | *Per cent.* | *Ounces.* | *Pounds.* | *Ounces.* |  |
| January | 7, 834, 209 | 38. 93 | 29. 11 | 3, 050, 358 | 114, 042. 34 | $15 04 |
| February | 6, 816, 525 | 40. 09 | 26. 42 | 2, 732, 979 | 90, 061. 88 | 16 45 |
| March | 6, 909, 070 | 38. 66 | 22. 24 | 2, 671, 149 | 78, 882. 22 | 16 92 |
| April | 6, 353, 800 | 37. 78 | 21. 97 | 2, 395, 939 | 69, 810. 76 | 15 90 |
| May | 5, 483, 616 | 37. 25 | 19. 30 | 2, 042, 877 | 53, 755. 88 | 17 28 |
| June | 6, 054, 960 | 35. 85 | 23. 59 | 2, 170, 602 | 71, 436. 77 | 14 40 |
| July | 7, 057, 717 | 37. 27 | 22. 72 | 2, 630, 296 | 80, 177. 74 | 11 42 |
| August | 7, 722, 812 | 36. 32 | 20. 85 | 2, 805, 026 | 80, 520. 33 | 10 86 |
| September | 7, 794, 997 | 36. 60 | 18. 15 | 2, 853, 422 | 70, 767. 59 | 10 77 |
| October | 7, 991, 092 | 35. 70 | 23. 45 | 2, 853, 261 | 93, 722. 75 | 10 29 |
| November | 7, 817, 206 | 34. 50 | 39. 74 | 2, 696, 863 | 155, 354. 21 | 10 52 |
| December | 7, 490, 111 | 33. 66 | 53. 39 | 2, 521, 417 | 199, 957. 22 | 12 00 |
|  | 85, 326, 115 | 36. 83 | 27. 15 | 31, 424, 189 | 1, 158, 489. 69 | 13 29 |

*Bullion produced.*

| Month. | Bullion. | Assay. | Contents. |  | Salvage. |  | Cost of producing 1 ton of bullion. |
|---|---|---|---|---|---|---|---|
|  |  |  | Net lead. | Silver. | Lead. | Silver. |  |
| 1883. | *Pounds.* |  | *Pounds.* | *Ounces.* | *Per cent.* | *Per cent.* |  |
| January | 2, 568, 029 | 88. 12 | 2, 560, 290 | 113, 148. 67 | 83. 93 | 99. 21 | $45 88 |
| February | 2, 450, 617 | 76. 35 | 2, 444, 203 | 93, 543. 53 | 89. 43 | 103. 86 | 45 76 |
| March | 2, 558, 685 | 64. 71 | 2, 553, 021 | 82, 793. 23 | 95. 57 | 104. 95 | 45 69 |
| April | 2, 357, 902 | 66. 34 | 2, 352, 559 | 78, 214. 00 | 98. 15 | 112. 03 | 42 89 |
| May | 2, 077, 869 | 58. 11 | 2, 073, 724 | 60, 380. 50 | 101. 50 | 112. 30 | 45 60 |
| June | 2, 184, 007 | 64. 81 | 2, 179, 157 | 70, 778. 40 | 100. 39 | 99. 07 | 44 78 |
| July | 2, 792, 481 | 64. 40 | 2, 786, 311 | 89, 938. 02 | 105. 93 | 112. 17 | 28 87 |
| August | 2, 807, 017 | 57. 15 | 2, 801, 520 | 80, 216. 64 | 99. 87 | 99. 62 | 29 92 |
| September | 2, 685, 030 | 49. 18 | 2, 680, 501 | 66, 024. 33 | 93. 93 | 93. 29 | 31 26 |
| October | 2, 706, 054 | 60. 76 | 2, 700, 418 | 82, 210. 41 | 94. 64 | 87. 71 | 30 40 |
| November | 2, 525, 070 | 107. 84 | 2, 515, 734 | 136, 134. 54 | 93. 28 | 87. 62 | 32 56 |
| December | 2, 305, 031 | 156. 03 | 2, 292, 696 | 179, 826. 71 | 90. 92 | 89. 93 | 39 00 |
|  | 30, 017, 792 | 75. 05 | 29, 940, 134 | 1, 133, 208. 98 | 95. 28 | 97. 82 | 38 09 |

About 12 miles from Santa Clara River the Mountain Chief Company owns several prospects, the value of which is being tested by tunnels which have been run in the side of the mountain about 40 feet. The ore assays upwards of 70 per cent. lead and 12 ounces of silver to the ton, with a little gold.

*Bradshaw district.*—The Cave mine was located twenty-four years ago by John W. Bradshaw, who, with some Minersville parties, formed a company and worked the mine about two years. The company became indebted for $30,000, and the property was sold on execution for $10,000 to W. S. Godbe for the Frisco Smelting Company. The ore was first used simply for a flux with other ores at the smelter at Frisco. The extension of the tunnel disclosed the wonderful succession of caves carrying high-grade carbonate and iron ores.

The Frisco Smelting Company afterwards formed a corporation known as the Frisco Mining and Smelting Company, and in 1880 bought the Cave, Carbonate Smelter, and some other minor properties for the sum of $400,000. The Cave is reputed rich in the value of its ores. The finest is said to yield 1,000 ounces in silver and 16 ounces in gold, and is described as lying above a vein of native sulphur 2 feet thick in some places. There are other rich veins, but the general average of the ore in car-load lots is 50 lead, 26 silver, and half an ounce of gold, with perhaps 25 per cent. iron, the lead all carbonate and fluxing itself. The ore is no longer delivered at Frisco; the company are trying to persuade the railroad to extend a switch out to the mine from Milford, and send the ore of this mine and that of the Carbonate to Sandy. The main tunnel will measure 1,300 feet; there are 11,000 feet of tunneling in all. A 500 foot tramway is well under way, and new hoisting works are on the ground. Twenty men are employed, and large bodies of ore have been stoped and are ready for shipment. Some desultory work has been done in a location called the Summit, above but adjoining the Cave.

The vein matter of the Carbonate is mainly trachyte, soft and light, mixed with rich argentiferons galena, in the proportion of three parts trachyte to one part galena. The mine is opened by a series of levels; it has steam hoisting works, and water is at hand.

The Carry lode mining property is situated near Lober's Cañon. The vein is a true fissure in a limestone formation. The main working shaft is now down to a depth of 40 feet, and follows the ledge, which dips west at an angle of 45° from the perpendicular. There is a vein of clean ore running through the ledge, which has an average width of 12 inches. A drift is being run into the ledge at the bottom of the shaft, which is now in a distance of 10 feet, exposing a fine body of ore. The ore is carbonate, mixed with chloride of silver, and assays 70 ounces silver and trace of gold. The ledge can be traced on the surface for a distance of several hundred feet.

*Star district* is a spur of the Wasatch Range. There is but little outside capital in the district, the mines being all worked by the owners, who are poor prospectors. But little ore has been shipped during the year, the principal work being development. While there is very rich ore in some of the mines, the average is low grade.

Mr. Peter S. Martin, of Frisco, describing Star district, says:

"The range is situated 5 miles southwest of the town of Milford and 9 miles southeast of the Horn Silver mine, Frisco. It has been noted, even in a rich mineral country, for the number of surface deposits of ore. The greater portion of these have been exhausted. The miners have been energetically at work looking for second bodies of ore, and some have been found. About twenty-five men are steadily at work. The ore is very easy to smelt, being carbonate and galena mostly.

Among the more prominent mines, beginning at the north and west side of the range, are the Stalwart, patented, opened by an incline shaft 220 feet deep, shows 8 inches of 500 ounce ore in the bottom of the mine. Shipments in 1883, $2,500.

Talisman, patented, adjoining the first named, has a net-work of quartz veins. Considerable ore is in sight and work is being vigorously prosecuted.

Savage and Hoosier, patented, has produced 4,000 tons of ore. It is idle at present, and will require capital to make it productive.

Eight men have been steadily at work opening up the Mammoth mine; 200 tons of 50-ounce smelting ore are on the dump.

The Uranus, patented, has struck a new strike carrying 300 ounces of ore.

The Boston, patented, and said to be a fissure vein, carries fine smelting ore and is being steadily developed.

The Kanarra has been steadily worked and has shipped 120 tons of ore during the year."

The yield of the district for 1883 is given as:

| Mine. | Gold. | Silver. |
|---|---|---|
| | *Ounces.* | *Ounces* |
| Stalwart | 2½ | 2,400 |
| Kanarra | ........ | 3,960 |
| Elephant | ........ | 600 |
| Magnolia | ........ | 1,200 |
| Morehouse | ........ | 500 |
| Creedmoor | ........ | 320 |

*Copper Gulch.*—The Comet continues the work of development, sinking its shaft deeper and drifting on the vein.

At the Cactus the pump was put down to the 300-foot level, and a new concentrating mill erected. A 200-pound sample, shipped to Paris, was found to be composed of pyrites of copper, copper-silver glance, and wire silver. Ore was encountered at a distance of about 65 feet from the shaft, on the third level, that continued for several feet. The showing of silver found in this new strike is better than any heretofore found in the mine.

*Beaver Lake district.*—This mining district is situated in a range of hills running north and south, between the San Francisco Mountains and Rocky mining district, about 10 miles northeast of Frisco. The southern half of the district is of a porphyry and granite formation, in which are found ledges of iron and copper ore. Outside of the Mooney iron and the O. K. copper mines, there has been no work nor prospecting done to amount to anything in this part of the district.

The northern half of the district is of a limestone and quartzite formation, and the ore generally of a high grade, being a compound of galena and spar mixed with black metal and chlorides. A piece of float found on the hills assayed over 800 ounces in silver. Mineral-bearing ledges run through this part of the district that can be traced on the surface for thousands of feet, as yet untouched by pick or drill.

The Nabob, situated in the foot-hills about 1½ miles north of the west spring, has been leased to different parties who have taken out of the mine several thousand dollars' worth of ore. These parties did nothing towards prospecting the mine and did not even hoist the waste rock, but packed it away in the mine. The present owners have cleaned out the mine and have gone to work in earnest to develop it. The main shaft, an incline, 85 feet in depth, was sunk on a vein of ore which dips into the hill in an easterly direction. From the shaft four drifts have been run on the vein, two in a northerly and two in a southerly direction. Work at the present time is being prosecuted in the drift running north 80 feet below the surface and is now in 30 feet. What in the beginning was but a narrow seam of ore has opened out into a vein 18 inches in width. The vein runs diagonally across the face of the drift, a 5-inch seam of high grade ore running through it. A large vein or ore, which is in some places 5 feet in width, crops out on the surface directly above the direction of this drift, which can be traced for a distance of 300 feet. The ledge matter is becoming wider and the face of the drift softer; in fact, there is every indication that this vein will soon be tapped and a large body of ore encountered. There are four men at work.

The Blue Bird has two seams of ore, 6 and 8 inches, respectively, running from the surface. These seams are about 4 feet apart and run through decomposed black lime and iron. A shaft has been sunk to a depth of 30 feet. The north side of the shaft seems to be all ledge matter to a depth of 15 feet; here the ore dips to the northeast into the hill. The shaft leaves the ore here and continues down perpendicularly, it being the intention of the owners to sink 75 or 100 feet and then drift to the ledge.

The White Mountain is about half a mile north on a hill adjoining the west slope of the Big White Mountain. There is a 15-foot incline shaft on the claim, exposing a vein of ore 15 inches in width at the bottom of the shaft. There is a regular hanging wall of limestone. The shaft is sunk through a species of quartzite rock; the ore is carbonate, and assays 107 ounces in silver, and 41 per cent. lead.

The O. K. mine is situated in the extreme southern part of the district. There are three shafts in the mine, the west one being down 175 feet, the center 85 feet, and the east or main working shaft is sunk to the depth of 230 feet, and is connected by a drift with the bottom of the center shaft. A drift has been run across the ledge at the bottom of the 85-foot shaft for a distance of 62 feet through ore matter, and as yet the wall has not been reached. The main shaft is running through ore at the bottom for a distance of 45 feet, which assays 40 per cent. copper and 19 ounces silver. A drift is now being run from the bottom of the main shaft eastwardly through the ledge and through ore that assays 52 per cent. copper. The owners began work on the O. K. on the 2d day of January, 1881, since which time they have erected a first-class whim. There are several hundred tons of ore piled on the dump, which will assay between 35 and 52 per cent.

On the Lula no work was done.

## EMERY COUNTY.

In Emery County a new district has been organized in the neighborhood of Castle Valley and Price River and near the Denver and Rio Grande Railroad, from which it is distant about 8 miles. There are 75 recorded locations and some fifty or sixty miners in the district. The ore is said to be similar to that of Silver Reef, and averages 30 ounces of silver with some copper, although some assays have gone much higher in silver and 40 per cent. copper.

## JUAB COUNTY.

*Tintic mining district.*—This district is in Oquirrh Mountain, 80 miles southwest from Salt Lake City, and comprises an area of over 100 square miles of the mineralized portion of this mountain range, and in point of developments takes precedence of all other mining districts of Central Utah. The geological formation comprises porphyry, granites, hornblende, quartzites, sandstone, and limestone; the limestone is lower silurian and much altered in its character and appearance by the action of eruptive igneous rocks. In the western part of the district the ores are contained in vertical fissures, cross-veins cutting the main ledges at various angles; they are rebellious, and contain gold, copper, silver, lead, antimony, iron, and arsenic. In the eastern part of the district the ore deposits are found in contact veins between granite, quartzite, and limestone; the vein matter contains crystal spars of many different varieties.

The Salt Lake and Western Railway, which has been completed to Tintic, shipped during the first five months of the past year 4,550 tons of iron ore, 3,100 of lead, silver, and copper ores. A branch road has been completed from Ironton to Silver City; this road leaves the Utah Central at Lehi Junction 31 miles south of Salt Lake, and runs south to Tintic, the present terminus being Silver City. This line is 55 miles long, and has in addition a branch extending to Mammoth, 3 miles distant.

The Mammoth is the greatest mining property in Tintic. It is situated on the westerly foot-hills of Mammoth Mountain, and comprises the Mammoth, Crismon-Mammoth and extensions, and the Mammoth-Copperopolis mining claims. This lode, pronounced by scientists to be a fissure in the lower silurian limestone, is remarkable for its size and for the value of the ores extracted. These ores are chiefly copper carbonates and oxides, carrying gold and silver.

The Crismon-Mammoth and its extensions have been worked almost continuously since their discovery in 1869. To facilitate the workings two shafts have been sunk from the surface to a depth of nearly 300 feet, where they are intersected by an adit 600 feet long. From this level a winze has been sunk to a depth of 200 feet; from the winze cross-cuts have been made at various depths, showing a vein formation here 60 feet wide. The openings, or workings, at the present time aggregate over 3,000 linear feet.

In pursuance of the plan adopted by the company to put up 22 additional reverberatory furnaces, with crushing and refining works for the separation of ores by the electrolytic process, in the early part of the year 1884, 14 furnaces were erected and put in partial operation, and the refining works were nearly completed when the death of the principal member of the English syndicate which purchased the property brought further operation to a standstill. The company was in debt for mine supplies, material, and for labor to miners and others over $150,000. Near the close of the year efforts were made to settle these claims upon the basis of 25 cents on the dollar for all the principal creditors, with an understanding that if a settlement was effected operations would be resumed. The present plant has a capacity for treating daily 100 tons of mixed copper, silver, and gold Tintic ores, and if completed as planned can double the amount, and the mine and its various works would, it is estimated, afford employment to over three hundred men, including skilled workmen, and require nearly 250 tons of coal to be able to extract and treat 200 tons of ore per day.

The American Eagle Mining Company is working fifteen men, principally on milling ore. The output averages about 10 tons daily; it is divided into two classes; the first class assays from $60 to $120; the second from $40 to $60 per ton in gold and silver. The greater part of the ore is high-grade copper, containing gold and silver combined. During October the company shipped 200 tons of the first class ore to Denver; they have discontinued the shipment of this class on account of the high rates of freight charged by the railway companies. The mine contains about 2,000 linear feet of workings, and the greatest depth attained is 250 feet. An adit has been opened 450 feet in length, tapping the vein 200 feet below the outcrop. An ore house has been built at the mouth of the tunnel, and a road constructed to the upper workings, where some 60 tons of high-grade gold ore was extracted during the month of December.

The Carissa and the North Star are among the producing mines in this district.

The Eureka Hill Mining Company, in the northern part of the Tintic district, continue to develop their mines and to extract and ship ore. The property of this company, consisting of patented claims, has been worked quite extensively. The shafts and tunnels in the various mines aggregate 6,000 linear feet. The main shaft is sunk to a depth of 500 feet and a 50-horse-power engine is used in it. About 1,000 tons of ore are mined per month and sent to Sandy and Colorado to be smelted. The company usually employ seventy men during the summer and a large number in the fall.

The Bullion, Beck, and Champion mines adjoin the Eureka Hill. They extend over patented ground, 2,700 feet by 300, and are developed to a depth of 300 feet, and have 2,000 feet of workings. There are large ore reserves, assaying 30 per cent. lead and 30 ounces of silver per ton. At the 300-foot level the vein is 12 feet wide and shows ore of better grade than that exposed in the upper workings. About thirty men are employed and the output is 20 tons of ore per day. The company have on their premises concentrating works run by a 40-horse-power engine for the treatment of ores too low in grade for shipment.

The Cornucopia, one of the group east of the mines last mentioned, has a shaft sunk 200 feet. Hoisting works have been erected, using steam-power and the patent skip to facilitate operations. About twenty men are employed.

The *Mono mining district* is in the northeastern part of Juab County, near the town of Mono, situated on the Utah Central Railway, about 83 miles from Salt Lake City. Work has been prosecuted during the summer upon two locations near Bear Cañon and the group in Stuart Cañon. Of the latter the principal mine, the War Eagle, is an old abandoned location relocated in the spring of 1883.

The Rose of Tintic Company owned several claims, the Rose of Tintic, Star of India, Ono, Josephine, and others. The price given to laborers, some of whom are stockholders, is stated to be 33⅓ cents per hour, 9 hours constituting a day's work. The cost of sinking shafts and winzes, 4 by 6 inside timbers, is $6 to $8 per foot; cross-cuts and drifts, 4 by 6 feet, $4 per foot; tunnels, $12 to $20 per linear foot.

The Northern Spy is on the eastern slope of the Mammoth Mountain. The gangue of its vein is a porous quartz, and the precious metals are caved in its cellular tissue. The character of the ore at a lower depth changes; copper as azurite and malachite carrying gold and antimonial silver crops in rapidly. The main shaft has been sunk 300 feet. The work has been prosecuted most of the time in ore which has yielded $70 per ton in gold and silver, in nearly equal proportions. The ore is free-milling.

The Julian Lane, between Diamond and Silver City, is developed to a depth of 300 feet; the ores run from 30 to 2,000 ounces silver and 3 to 10 ounces of gold to the ton.

The Tintic Iron Company own a number of iron mines near Silver City. The ores are shipped to the Horn Silver and other smelting works, to be used, principally, as a flux in smelting other ores. They contain from $5 to $15 gold and silver.

In the *Mount Nebo mining district* several claims have been made on the side and near the summit of the mountain, which attains an altitude of nearly 12,000 feet above the level of the sea, but no shipments have been reported.

The *West Tintic mining district* is on the westerly slope of the Onoqui or Skull Valley range of mountains, which traverses the country from Salt Lake to the Desert. The ore veins are usually found between two formations, being the so-called "contact veins," which have a vertical dip. The mines have been opened by shafts ranging from 20 to 200 feet in depth.

The Scotia is situated near the center of the district. It is opened by three shafts, two of which have been sunk to a depth of 200 feet and one to a depth of 100 feet. The vein is about 5 feet wide; lead 25 per cent. and silver in combination 20 ounces per ton.

The January, southwest from the Scotia, is opened by a shaft 160 feet deep, which exposes a contact vein between limestone and quartzite from 1 to 6 feet in width. A lot of several tons of ore gave 59 per cent. and 119 ounces silver per ton.

The Enid and the Shoo Fly, south of the January, the Jersey Lily and Fairview, on the north, are, as yet, but prospects.

In the *Desert district* are many promising claims, carrying copper carbonates, black oxides of copper, and copper pyrites, which contain iron, with a small amount of gold and silver.

The Eighteen Hundred and Eighty-three is a contact vein and has been worked to a depth of 60 feet on the incline. The ores are gray carbonates of lead, 30 per cent., carrying silver from 10 to 20 ounces per ton.

The *Dugway district* is on the boundaries of the Great Desert. It has veins of gray carbonates of lead of high grade, with silver in combination.

The *Detroit mining district* is in a mountain range which rises from the midst of the desert and contains veins which run northeasterly and southwesterly, dipping slightly to the east; the vein matter is quartz, containing copper, silver, and gold.

The E. P. H., in this district, has been opened to a depth of 200 feet, and shows blue and green carbonates of copper and dark-colored oxides, associated with bismuth.

The Juno, the Howard, and Amie are north of the E. P. H., and upon veins which contain copper, green and blue carbonates, gold, and silver, but are undeveloped.

From the stoppage of the Mammoth Mining and Milling Company the production of Juab County has been reduced, and I have estimated it for 1883 at $40,000 in gold and $290,000 in silver.

## PI UTE COUNTY.

*Marysvale.*—The principal mineral belt in this county is situated on the eastern slope of the Wahsatch Range, and, commencing near the north line of the county, it extends south for 15 miles, crossing Ten-Mile Creek in its course. This mineral belt runs north for about 6 miles into Sevier County, and it contains gold, silver, galena, copper, and quicksilver. The altitude of the range in this vicinity varies from 7,000 to 9,000 feet. The greater portion of the mines are near the summit. Numerous creeks yield a plenteous supply of water for all purposes. The town of Marysvale is situated in the Sevier River Valley, 90 miles southeast from Juab, a station on the Utah Central Railroad. The valley extends nearly 150 miles from Juab, and is very fertile, while on the mountains numerous herds find pasturage. The ground in the valley is seldom covered with snow, but on the mountains the fall is from 6 inches to 4 feet, according to altitude, but it never interrupts mining. The Denver and the Rio Grande Company has a railway surveyed from Salt Lake City south to Arizona, which, passing through the district its entire length within 3 miles of the mines, will probably be completed to Marysvale during 1884. Development of the mines has been restricted, owing to two causes: (1) The mines are generally owned by the original locators, who are mostly persons of small means lacking sufficient capital to work them. (2) The location being so far from the railroad, capital has not found its way there for investment.

*The Ohio district*, west of Marysvale, is situated on Pine Creek, in Bullion Cañon, and extends 10 miles east and west by 6 miles north and south, reaching from the foot hills to the summit of the mountains. The district contains over one hundred mining locations. For want of capital many are but prospects, which, however, show as well on the surface as those which have been more developed. The mountain on each side of Pine Creek rises quite abruptly. The strike of the veins here is nearly north and south, and crops out on the side of the mountain.

The Bonanza, Mexican, and Gold are three prospects recently located on a 60-foot ledge, carrying gold and silver in appreciable quantities.

The Elgin is located on Pine Creek. The development consists of a tunnel, which extends south from the creek. A 4 foot vein of ore has been exposed, which assays nearly $50.

The Navigation is situated on the same vein. There are two tunnels of 100 and of 30 feet, respectively, which have disclosed galena and milling ore, which assays over $40 per ton. In this mine the vein is 8 feet wide.

The North Star and the Morning Star are two claims on the same vein. On the North Star there is an open cut 25 feet deep and an inclined shaft has been sunk 60 feet, disclosing a large ledge of vein matter and an 8-foot vein, which assays over $50 per ton.

The Morning Star has a shaft 120 feet deep, also an adit in 120 feet, showing a 6-foot vein of milling ore, which assays over $50. With depth this vein improves in richness. There is a large force of men now at work on the two Star mines with supplies for the winter. A good wagon road runs up Pine Creek to these mines, which is convenient for hauling ore. The country rock in the vicinity is quartzite and porphyry, the latter lying over the former.

The Belcher is about 100 feet east of the Star. There are two tunnels of 75 feet and of 50 feet, respectively, showing about the same sized vein and quality of ore as the Star. These tunnels are all on the veins, and can be extended four or five hundred feet farther.

The Washington and Chattanooga claims are situated about 200 and 400 feet, respectively, from the Star mines, and show veins similar to them. and the amount of work and development is about the same as on the Star.

The Highland Mary, east of the Chattanooga, has a tunnel run on the vein 20 feet. The ore is galena and free milling.

The Homestead and Webster are situated on the same vein, which extends over 5,000 feet. They are about 400 feet from the Chattanooga, to the east, and parallel with it. There is a shaft 100 feet deep, with a cross-cut at the bottom 60 feet in length all the way on the vein, and shows a very large quantity of ore.

The Webster is south of the Homestead, and has also a shaft 100 feet deep with a cross-cut at the foot. About 300 feet south of the shaft is a tunnel cut across the vein; this tunnel runs in from the surface diagonally. The Homestead and Webster are patented.

The Wyoming is still farther to the east. It has a tunnel run in about 75 feet, which shows a 4-foot vein of ore.

The Osceola adjoins the Wyoming, and has a tunnel run on the vein about 100 feet, where the vein shows 6 feet of milling ore.

The Fillmore and Elsie are 600 feet east of the Homestead, on the same vein, extending 3,000 feet.

The Fillmore has an inclined shaft 53 feet deep, with a cross cut at the bottom extending 20 feet to the west wall; 20 feet south of this shaft is another, having a depth of 18 feet and a level running in a southerly direction 120 feet. The ledge is over 15 feet wide.

The Elsie, to the north of the Fillmore, has a tunnel 120 feet deep, which discloses a large vein of good ore.

The Mohawk and the Eastern are 400 feet east of the Elsie. On these two locations are four tunnels over 100 feet in length. Here the vein is large, showing good ore in contact formation.

The Sierra Nevada, Mammoth, and Grand Central are south of the Mohawk on the summit of the ridge. These are three very large ledges and promising claims.

The Beecher, on the hill with the Great Western, has a large amount of work done on it, at an expense of over $1,000. It shows a large body of ore of medium grade.

The Occident and Moose are on one ledge, which is 100 feet wide, extending from the northeast to the southwest. On the Occident there is a shaft 30 feet deep and a 50-foot tunnel, and shows a fine body of free-milling ore in quartzite.

The Moose has a 30-foot tunnel.

The Blanchetto and the Silver Cliff are near the foot-hills. These claims join and show a vein over 8 feet wide. The Silver Cliff has a 60-foot tunnel. On the Blanchetto there is a shaft 6 feet deep and a cross-cut 8 feet on the vein.

The Copperbelt is located on Copperbelt Ridge, which is 9,000 feet high, about 2 miles north of Pine Creek. The mine has a shaft 300 feet deep, which shows a 3-foot vein. A large amount of rich ore has been taken from this mine, some shipped 200 miles, to Salt Lake City, netted over $200 per ton.

There are several other prospects on the ledge with the Copperbelt, and showing the same outcrop, but as yet undeveloped.

To the east, near the foot-hills, is the Sonora, a fine prospect. It has a tunnel run into the hill on the vein over 60 feet, with a shaft 25 feet deep at the end of the tunnel, and shows a vein of milling ore 8 feet wide. This mine is 3,000 feet below the Copperbelt on the same line of formation.

Near the mouth of Bullion Cañon there is a fine ten-stamp mill, with two True vanners attached. The water-power of this mill is sufficient except in very dry or extreme cold weather.

The *Mount Baldy mining district* is south of the Ohio, and extends about 10 miles from north to south.

In this district is the Daisy, on the foot-hills of the mountain, 2 miles south of Pine Creek; also the Green Eyed Monster; and continuing south the Deer Trail, Cliff, Alma, and the Pluto.

The Pluto has over 900 feet of development work, consisting of a tunnel and shafts, and has produced a large quantity of gold and silver ore, a part of which was treated at the Copperbelt mill.

On the Green Eyed Monster and Deer Trail a large amount of work has been done.

The Green Eyed Monster has a tunnel run into the hill 500 feet, and shows a 50-foot vein of free, milling gold and silver ore, averaging $10 in gold and 10 to 30 ounces in silver.

The Deer Trail has produced several hundred tons of high-grade galena ore, which netted over $200 per ton.

The Cliff, though developed less than the Deer Trail, shows ore of the same character.

The Alma is a continuation of the Cliff, with similar ore and formation; $2,000 have been expended on development.

The Belvidere is a large iron mine, carrying gold; a fine ore for flux. Over $1,000 has been expended in tunnels and shafts.

The Rothschild is a gold and silver mine. At the north end there is a 100-foot tunnel running in on the vein, which at this point is 6 feet wide, the ore averaging $40 in silver and being free milling. At the south end there is a shaft 75 feet deep, all in ore vein, 4 feet wide. The owners have not the capital to erect a mill.

The Uncle Sam adjoins the Rothschild on the same vein. It is patented, and in character is like that of the Rothschild.

The Bell is still further south, and shows a 2-foot vein of gold and silver, some of the ore being high grade.

The Clyde is in the vicinity of Cottonwood Creek, 3 miles from its mouth. The shaft is down between 200 and 300 feet. A tunnel has been driven in 1,000 feet; these works show some fine ore.

The Butler claim, recently discovered, is about 1 mile north of the Clyde, lying on a large ledge, which shows a fine vein of free-milling quartz.

The Crystal is on the side of the Cañon, half a mile west of the Clyde. There are four incline shafts from 1 to 300 feet deep. Nearly 1,000 tons of ore have been mined, which still lies on the dump.

The Bushy and Bestont are about 1 mile northwest of the Crystal. These two claims are among the best in the camp, and are valued at $5,000 each. The country rock is all porphyry veined in quartz.

I estimate the production of this county to be $5,000 gold, and $10,000 silver.

## SALT LAKE COUNTY.

In Salt Lake County are located the principal smelters and extensive sampling works, and the county is quite as celebrated for its metallurgical operations as for its mineral production. It however contains several important districts and many valuable and noted mines.

The *American Fork and Silver Lake district* is south of the *Snake Creek district*, from which it is separated by Pittsburgh Hill. Geologists who have visited and examined the district describe the formation as granite, underlying the whole quartzite, schist, and magnesian limestone in successive layers above. The overlying limestones are from 1,000 to 2,000 feet in thickness, and on the sides of the gulches and cañons have been broken and worn into bold and grotesque forms, resembling massive fortresses, lofty towers, and ruined battlements.

The relative position and character of the rocks are plainly exposed in contorted and broken strata on either side of the American Fork and neighboring gulches, which have been broken or cut through the limestones and quartzite.

The principal developments in this district have been made in the Live Yankee extensions, Silver Bell, Mono, Henriette, Eudora, First Chance, Last Chance, and Red Cloud.

I am under obligations to Mr. W. S. Pierce, of American Fork, for detailed information concerning several mines in that vicinity. From him and other sources I learn that the Live Yankee, which includes several adjacent locations and extensions, has a large body of low-grade ore, in opening which a working force not exceeding twelve men has been employed in running a tunnel.

The mineral is found in a contact vein between quartzite and limestone, from 30 to 50 feet in width.

The Silver Bell Company own the location by that name and the Mono, Eudora, First Chance, Henriette, and Red Cloud, located upon a vein similar to that of the Live Yankee, from 1 to 8 feet in width, have developed their property by an incline to a depth of 400 feet, with tunnels and drifts over 1,000 feet, upon which a working force of ten men was employed in tunneling without extracting or shipping ore. It owns a mill site containing an abundance of pine timber and good water-power. The adit tunnel of the Silver Bell has penetrated over 900 feet through the solid mountain. In the shaft the working stopped at a depth of 400 feet from the surface, in a wide vein (50 to 60 feet), with ore carrying 40 ounces of silver—no lead. The adit struck ore from 75 to 80 per cent. lead, and 50 to 60 ounces silver. The Silver Bell tunnel is in 1,300 feet, which is to be extended 1,100 feet farther and strike their shaft at a depth of 700 feet.

The Cariboo Company worked a small force in their lower tunnel. The ore assays $15 in gold, over 100 ounces in silver, and 54 per cent. lead.

The Treasure, situated on Miller Hill, has a vein carrying, so Mr. Pierce states, over 400 to 500 ounces in silver to the ton. It is developed by a tunnel and several drifts.

The Miller Mining and Smelting Company own several locations, which have been opened by several tunnels, crossing Miller Hill diagonally in an easterly and westerly direction, which cut the lodes at various depths, the lowest at 400 feet below the surface. The veins run from 3 to 30 feet in width, and the ore $47 a ton and upwards.

The Queen of the West employed six men extracting ore carrying over 80 ounces of silver and 50 per cent. lead.

The Wild Dutchman, on Miller Hill, owned by the Omaha Smelting and Refining Company, is located upon a vein 3 to 5 feet wide, containing galena and carbonates. It is developed by over 10,000 feet of tunnels, drifts, shafts, and inclines.

In this vicinity are several other mines, not as yet shipping ore, but which are reported to have been extensively developed, among them the Austin, Sierra, Bellerophon, and Little Cloud.

The Utah Consolidated Silver and Gold Mining Company have bonded quite a number of locations upon veins in Miller Hill, some of it containing gold, silver, and sulphuret and carbonate of lead, and others free gold associated with chlorides and bromides of silver.

The Milk Maid, in the *Silver Lake district*, was worked under a lease, and gave employment to sixteen men, who extracted from 10 to 15 tons of ore per week. The mine is troubled by water, which has to be pumped out through the shaft at considerable expense. This, it is believed, can be avoided by running a tunnel to the vein. Five hundred tons extracted from the Milk Maid and sold returned 43 ounces in silver, 42 per cent. lead, and $2 gold to the ton.

West of the Milk Maid are the Good Hope and Alderney mines, in granite formation, and as yet but slightly developed. The ore contains silver, gold, and a small percentage of lead.

In this district the only producing mines reported by Mr. Pierce are the Wild Dutchman and Milk Maid.

*Bingham district* is situated in the Oquirrh range of mountains, which form the western boundary of the Salt Lake Valley. It is 25 miles west of Salt Lake City and is one of the oldest mining districts in Utah. It was worked for many years as a placer country, but subsequently argentiferous lead ores were discovered, which are now the principal sources of its production. The district has several subdivisions, *i. e.*, Butterfield

Cañon, Black Jack, Carr Fork, Copper Gulch, and Highland. The principal mines are the Winamuck, Dixon, and Tawanga. The shipments from the last named are reported at 70 tons, the most of which carried from 60 to 70 ounces; fonteen men were employed in development work and mining.

Butterfield Cañon contains some of the most important mines in the county. The Yosemite employed during the summer twenty-five men and in the winter seventeen, extracting, on an average, 223 tons of ore per month; the property embraces several locations, *i.e.*, the Yosemite, West Extension, Jupiter, and Granada, through which a vein extends, and they have been developed for a length of 2,400 feet. The company has erected hoisting works, ore house, blacksmith shop, boarding-house, assay and general office, and has provided a concentrator and ore-crusher with a capacity of 40 tons in 24 hours. Openings have been made, consisting of a tunnel, levels, drifts, and an inclined shaft down 625 feet. The process of extracting the ore is inexpensive and simple.

The Brooklyn, formerly known as the Martin, employs from eighty to ninety men, and ships daily 30 tons of ore to the Mingo Smelter at Sandy. It has hoisting-works run by a 50-horse-power engine and works for concentrating low-grade ores, operated by fourteen men. Miners are paid at the rate of $3 per day; board can be had for $1. The shaft, which is inclined at an angle of 40°, has been sunk to a depth of 1,000 feet, with levels at intervals of 100 feet, and drifts to the vein. A low-grade ore is exposed, which averages 11 ounces silver and 50 per cent. lead.

The Lead mine, on Copper Gulch, is located on a contact vein, between limestone and quartzite, which runs northeast and southwest, and dips 50° to the horizon. The ore is carbonate in an oxidized state; is free-milling, and averages 50 ounces of silver to the ton. It is shipped to San Francisco. The property embraces three claims: the Lead, Carbonate, and the Rustin. It is owned by an incorporated company, the Omaha Smelting Company, Mr. Honory, of Salt Lake, being the principal stockholder. Developments consist of a shaft 300 feet in depth, drifts and levels extending about 600 feet. The works have an engine-house and other necessary buildings. The company has erected, 3 miles below Bingham, a concentrator, which is worked by an engine of 50 horse power; also commodious buildings. The ore is dumped from the tramway into the ore house, and carried through crushers and revolving screens to the rollers. Three and one-half tons of low-grade ore are concentrated into one, and two shifts of seven men each can concentrate 100 tons in 24 hours. The best ore averages 19¾ gold and 2⅛ silver per ton, and the average of the concentration is 7 ounces of silver and 56 per cent. lead. The tramway leading to the mill is 4½ miles long, down a 24-inch grade, and is operated by mule power. The cost of hauling the ore from the mine to the mill is stated to be 50 cents per ton. The product of the concentrator of the Lead mine has been 4 ounces of silver and 55 per cent. lead and $1.50 gold to the ton.

The Wasatch is in the same mineral belt as the Lead mine, east of which it has a stamp mill. The mine is owned by the Winamuck Mining Company, but was operated during the year under a lease. It is opened by a tunnel reaching to the vein, and an inclined shaft down 220 feet, from which drifts have been run over 100 feet. The company has hoisting machinery with a 15-horse power engine, boarding house, blacksmith shop, &c. In this vicinity are numerous mines, most of which have been worked out and are idle. Only two have been worked during the past year, and these by Italians, who are reported to have taken out from $5,000 to $6,000 in gold.

*Carr Fork.*—The Last Chance mine in this subdivision has been opened by a tunnel 500 feet in length. The mine is under lease, and is reported to have shipped ore netting $40 to the ton at the smelters; ten men are employed.

On the Sacred considerable development work has been done, 2 men being now employed in tunneling.

The Nast is opened by a tunnel. It has been worked under a lease, and some ore has been extracted and sent to the smelters.

The Sunset, the Wide West No. 2, the Sunrise, and the Elephant are all located near the head of Carr Fork.

The Sunrise and the Wide West are gold and silver mines, gold predominating in the latter, and the ore running $35 gold and $50 silver per ton in the former.

The Elephant is located on the ridge between Log and Carr Forks. It has been prospected by a tunnel over 800 feet into Bald Mountain, on a vein much broken and displaced, and pockets of rich ore and lead have been disclosed.

The Sunset, near the junction of Log and Carr Forks, contains free-milling ore, of which a large amount has been extracted and lies upon the dump. The vein is between lime and quartzite, and has been opened about 200 feet on the surface.

The Old Telegraph mine, in Bear Gulch, has been worked for several years, latterly under a lease. It mined and worked during the year over 1,000 tons of ore averaging $14 silver and $45 gold, and concentrated $10,000 worth of low-grade ore. The lessees erected, a short distance below the mine, a five-stamp concentrator, and employ eighteen men in the mine and mill.

In *Bingham district* there are many placer mines besides those yielding milling and smelting ores; among the latter from which shipments by rail were reported for October and November, 1882, are the following:

| | Pounds. | | Pounds. |
|---|---|---|---|
| Tiwaukee | 134,200 | Emily | 17,150 |
| Greeley | 32,750 | Hazelgrove | 5,225 |
| Haskins | 57,600 | Sundown | 530,170 |
| Julia | 5,750 | Telegraph | 124,730 |
| Savage | 7,700 | Highland | 17,450 |
| Spanish | 42,900 | Silver Shield | 44,800 |
| Silver Star | 52,500 | Kilkenney | 46,050 |
| Neptune | 104,920 | Last Chance | 32,160 |
| Murphy mine | 38,220 | Albino | 15,700 |
| Gilmer & Saulsbury | 67,460 | O. Telegraph | 279,330 |
| J. B. Rogers | 65,290 | Aladdin | 150,120 |
| Giant Chief | 71,650 | Lucky Boy | 5,770 |
| Gem | 125,560 | Virginia | 17,500 |
| Fraction | 8,020 | Watson | 80,940 |
| Miller | 17,750 | Hooper | 20,000 |
| Albino | 23,130 | Winnemucca | 15,380 |
| Markham | 16,300 | | |
| Ashton | 17,500 | Total | 2,319,534 |
| Williams | 27,859 | | |

*Little Cottonwood district.*—In the Emma mine 1,400 feet of levels, drifts, and cross-cuts were excavated during the year. A double compartment shaft, 5 by 12 feet in the clear, is being sunk at the face of the Bay City tunnel, 1,765 feet from its mouth. The engines that run the pumps and hoisting works are in the face of the tunnel and driven by steam furnished by steam conveyed through its wrought-iron pipes from four boilers, worked two and two alternately, at the mouth of the tunnel. In the old workings parties have been taking out some ore on shares, and the dump is continually worked over, yielding good pay by concentration.

Near the Emma mine, the Marion group is composed of 18 claims, and embraces a surplus area of 127 acres. The operations during the past year have been confined to development work in prosecuting three tunnels, from which the owner claims that he is now able to take out from 25 to 50 tons per day.

The Joab Lawrence Company has shipped regularly during the season from the Vallejo and North Star, working thirty-three men.

The City Rock group comprises the City Rock, Utah, King of the West, and several adjacent locations, which have been opened by several tunnels, one of which, the "lower tunnel," on Grizzly Flat, is in 1,900 feet. Two hundred feet above the latter the Topeka tunnel, which starts near the discovery shaft, is in 700 feet, and further up the hill the main, or City Rock, tunnel has been extended 1,200 feet to the northeast boundary of the company's ground in Big Cottonwood, and above that the discovery tunnel has been run 600 feet. The upper workings comprise drifts, levels, upraises, and winzes aggregating miles in length.

The Gardner & Morrill Company worked six men driving a tunnel on the Peosta lode. The company also owns the Snow Storm group, upon which the drifts, tunnels, and levels exceed 1,200 feet.

The Equitable Mining Company has several tunnels, the one upon the Lady Estin being 600 feet, upon the Phœnix 1,000 feet, and upon the Equitable 1,500 feet in length. The development was commenced twelve years ago, and has been continued from time to time, with, however, a small force only, a portion of the time consisting of but a single man.

The Evergreen has shipped 100 tons of ore.

The Goodrich is in 490 feet and has made large shipments from the upper workings.

The Montezuma group is opened by the Bucklin tunnel, which has been driven 1,200 feet under contract, and probably has yet 200 feet to run before reaching the ledge.

The Buffalo was started as a blind or prospect tunnel, but the company have purchased one or two locations on its line. It is about 1,300 feet, with nearly 300 feet yet to run.

## SEVIER COUNTY.

During the summer of 1883 a new mining district was organized on some new discoveries in the southern part of Sevier County, adjoining and east of the Sevier River, known as *Henry district.*

A large copper vein carrying gold was discovered, upon which three locations were made in June, 1883. A tunnel has been run across the vein, which is 20 feet in width.

The Antelope-Belcher, Sage Flat, and Mountain Lyon are all supposed to be on one vein.

The Antelope was the first discovered, showing an 8-foot vein of solid ore, some of which assays as high as $500 in silver and carries some gold. The ore is free milling, and the entire vein as far as developed will pay to mill. The owner has secured fine water-power—10,000 inches, with a 60-foot fall on a gentle down grade—for a mill about 1½ miles from the mine.

The Leopard is in the same district, about a mile from the Antelope, and on the surface shows a 3-foot vein of free-milling ore carrying gold and silver. An average of the surface croppings was $46 in silver and $4 in gold.

There are a large number of other locations in this district undeveloped, some of which are very promising claims. The country rock is all porphyry. No lime nor quartzite has yet been found.

## SUMMIT COUNTY.

The Ontario, including the other mines belonging to the corporation, continues to be one of the principal producers of the Territory. Although its production of silver was 155,628 ounces less than in the previous year, it, however, furnished and put upon the market 1,697,036 ounces of fine silver, worth at its standard dollar coining value, $2,194,147.

The principal event during the year in the history of this mine was the completion of the tunnel for draining the mine, which was commenced in the summer of 1881. It is over a mile in length, and was projected for the purpose of carrying off the water and reducing the expense of handling the ore, which can now be taken out of the 600-foot level, at which the tunnel strikes the ledge. By means of the tunnel the ore can be sent from the 600-foot level down to the mills on cars, saving the expense of hoisting the 600 feet, and then loading and hauling to the mill and unloading. The cost of the tunnel was over $20 per foot—something over $100,000.

The water from the mine is elevated to the tunnel by one 14-inch plunger steam-pump on the 700 level, and two compound 17-inch pumps on the 800 level, which elevate 2,700 gallons a minute. The water is believed to be surplus water percolating through the foot-wall rock, which pitches northward or toward the vein. Shaft No. 3, 11 by 20 feet in dimensions, tapped by the tunnel, has been sunk through the solid rock to the 800 level. Upon the drainage of the water down to the 800 level it is estimated that there will be taken out between the 600 and 800 levels over two years' supply of ore at the present capacity of the mill. The completion of this tunnel is considered of great value for the future success of mining, not only in the Ontario but in adjacent mines, because it is believed that it will drain a large area of the country, especially that portion lying south of the vein.

The fissure upon which the Ontario is located is found between walls of quartzite, with an occasional thin bed of shale intervening. The vein can be traced nearly 6 miles from Thayne's Cañon, southwest of Pinyon Hill, to McHenry's Cañon, the eastern foot-hills of the mountains.

The Ontario mill produces about 5,000 ounces of silver per day, and obtains from 89 to 94 per cent. of the assay value of the ore. The report of the company from April 1, 1881, to November 1, 1883, states that the receipts from bullion produced during the entire period amounted to $5,388,986.55, and the expense for working, improving, and acquisition of the property as follows: $3,450,379.17, which included over $93,000 expended in purchase of coal mines, and nearly $500,000 in the purchase of mining claims.

The Empire mining property embraces fifteen claims, ten of which have been patented. After expending a half million of dollars in development-work and machinery and the erection of a stamp-mill, in February, 1883, the property was attached for indebtedness, and subsequently passed into the hands of a new company. The property extends 4,000 feet westward from the Ontario, and is supposed to be on the same ledge. A large portion of the expenditures upon the mine were occasioned by the great quantity of water which was hoisted for a long time at a cost of $25 per day. When work was stopped upon the mine in February, 1883, the shafts and drifts were filled with water; but since the completion of the Ontario tunnel, which is 300 feet below the lowest point as yet reached by the Empire, the water has disappeared and the mine is dry.

Southwesterly from the Ontario, in a line towards the head of Big Cottonwood, is the Daly group of mines, upon which have been erected substantial hoisting works and a shaft sunk to the depth of over 250 feet.

South of this and parallel to the Daly group are the Putnam mines, which two groups occupy most of the ground to the White Pine and Bonanza Flat.

The White Pine is one of the oldest claims of the camp, situated in White Pine Ridge. Its shaft was sunk 100 feet ten years ago and rich ore extracted, assaying $250 per ton in silver and 40 per cent. lead. It changed hands several times. Its hoisting works were erected and new shaft sunk on the north slope and several cross-cuts run, but the ore extracted was quite base.

Farther south is the Utah, upon which $50,000 have been expended for hoisting works and machinery and in sinking its shaft to the depth of 450 feet.

Near the head of White Pine Cañon are a group of mines which are being developed by tunnels, one of which, the Silver, is in nearly 700 feet, and tunnels have been run upon others from 200 to 500 feet.

On the Bonhomme Group, on the east fork, about a mile from the mouth of Thayre's Cañon, north of Rebellion Hill, in *Uintah mining district*, a force of eight men has sunk an incline over 75 feet on a vein from 4 to 7 feet thick, carrying some carbonates and a large amount of black manganese.

The Crescent Company owns 90 acres of ground, 13 acres of it developed by 20,000 feet of openings. During the year it bought the Nettie, an undivided one-eighth interest in the Roaring Lion, completed the new ore-house in Thayre's Cañon, and commenced a tramway from the lower tunnel to the ore-house near the mouth of the tunnel. Eleven thousand five hundred and seventy-five tons were taken out and sold at $30.75 per ton, at a total expense for all purposes of $15.95, and a profit of $14.80 per ton. During the year nearly 8,000 linear feet of openings were made. The report at the November meeting showed receipts from ore sales of $348,000. Expenditures: dividends, $150,000; and purchase of Walker & Webster, $50,000; permanent improvements property on hand, $148,000; total, $348,000. The company is reported to owe only $42,000, and that on the purchase of the Walker and Buckeye.

The Apex Consolidated, adjoining the Crescent on the south, and comprising about 50 acres, is opened by a tunnel 450 feet in length, where it crossed a thin vertical sheet of ore which, on an upraise of 80 feet, opened to a thickness of 2 or 3 feet. The company produced during the year 5,100 ounces of silver. The mine made in June its first shipment of ore, three car loads of first class assaying about 90 ounces, and 30 tons of low-grade ore, shipped in December to the Macintosh sampler, assayed 20 ounces in silver and 25 per cent. lead.

The Silver Key has been opened by a tunnel driven eastward 500 feet, which struck about 50 feet from the entrance a vein of carbonate ore over 2 feet thick, upon which drifts have been run 200 feet, and a small amount of ore has been extracted.

Parley's Park is situated on the top of the ridge east of the Ontario, and supposed to be on the same vein. It is owned by the Standard Oil Company, who have sunk a 2-compartment shaft 900 feet, and have erected extensive hoisting works.

The Daly group of mines is in Empire Gulch, a short distance above the Empire, and consists of 62 claims, 26 of them patented, and covers 150 acres of ground. These locations are 1,500 feet west from the Ontario, to which the vein has been opened on the surface. Hoisting works have been built, with boarding-house and other buildings, for working the mine. Forty men are employed in and about the mine. The vein is said to be 25 feet wide with high-grade ore 3 feet in width.

The Climax, Pinyon, and Rebellion groups compromised their disputes and united to form the Crescent company. There have been 300 feet of connecting drifts.

The Roaring Lion, on Rebellion Hill, is developed by a tunnel and has been worked by 5 men.

The Council Bluffs Company owns several locations and has worked 8 men in development.

The Uintah employs 12 men in running two tunnels.

The Sampson is in Woodside Cañon, below Pinyon Hill. It has hoisting works, a 40-horse power, and 2-compartment shaft sunk, with drifts on the ledge east and west over 200 feet, and 4,000 feet of development in the old works. It shipped in June, 1883, 10 tons of first-class ore, which netted at Park City $1,100, and 20 tons of second-class ore which netted $800. The total production for the year is stated to have been 12,440 ounces. A contract was made for sinking a new shaft, which progressed at the rate of 3 feet daily to a depth of 200 feet. The company has driven a tunnel over 450 feet through solid rock, but has not yet struck ore.

I am under obligations to Hon. William M. Ferry, of Park City, Summit County, for the following statement as to the yield of the mines of Uintah which he states were the only producers in that section in 1883:

| Name of mine. | Gold. | Silver. |
|---|---|---|
| | *Ounces.* | *Ounces.* |
| Ontario | | 1, 697, 035. 86 |
| Crescent | 848 | 293, 127. 00 |
| Sampson | | 12, 440. 00 |
| Apex | | 5, 100. 00 |
| Silver Key | | 114. 00 |
| Roaring Lion | | 375. 00 |
| Sonthern Tier | | 3, 500. 00 |

## TOOELE COUNTY.

The Havana Mining Company owns three locations in *Clifton mining district* on the eastern slope of Deep Creek Range, 150 miles westward of Salt Lake. The formation is granite. A shaft has been sunk 300 feet and levels started. The ore has been uncovered, but very little, if any, extracted. Water was encountered at the bottom of the shaft.

In the *Clifton mining district* are several locations which have been worked during the year, among them the Confederate, Holy Terror, and I. O. U., upon which shafts have been sunk and small amounts of ore extracted.

At Ophir, on Chloride Hill, a tunnel run northward from the Chloride Gem is reported to have cut a ledge of good ore 15 feet thick, from which 300 tons were taken and laid upon the dumps. Among other mines more or less worked in this vicinity are the Green-eyed Monster, the San Joaquin, and the Chrysopolis.

## WASHINGTON COUNTY.

*Harrisburg district.*—The production of this district was somewhat less than in 1882, occasioned principally by the lessened output of the Stormont, which was about 182,000 ounces in 1883 as against 234,000 in 1882. During the summer the company worked 50 men in the Savage, Buckeye, and Last Chance, which are operated from the same vertical shaft 250 feet deep. The company has a 10-stamp mill, in which 12,000 tons of ore were crushed monthly.

The Barbee & Walker was worked by Gillespie Lund & Co., employing 16 men. Considerable ore was accumulated, besides what was taken out on the third, fourth, and fifth levels.

The Christy was steadily worked and its ores reduced at its 5 stamp mill at the rate of 50 pounds per day, and produced during the year silver bullion to the value, at its coining rate, of $262,310. Its official figures for the bullion output for six years have been—

| | |
|---|---|
| 1878 | $302, 537 |
| 1879 | 245, 466 |
| 1880 | 272, 084 |
| 1881 | 316, 040 |
| 1882 | 372, 426 |
| 1883 | 262, 310 |
| Total | 1, 770, 863 |

# CHAPTER XII.

## WASHINGTON TERRITORY.

The amount of gold received at the mints and credited to Washington Territory during 1883 was $25,332, being $1,300 less than in the previous year. The amount, however, carried by express, according to Mr. Valentine's estimate, was nearly 30 per cent. less, being but $67,309 in the last as against $93,892 in the preceding year. These facts indicate a decline in the yield, and I have estimated a gold production in 1883 of $80,000, and $500 silver.

The principal mining is done in Yakima County, although placer mining is prosecuted to some extent in Whitman and Whatcom Counties.

In regard to the mines in the vicinity of Ellensburg, the following is from a valuable communication received from Mr. Walter A. Bull:

"The Swauk placer mines, 25 miles from Ellensburg, have yielded in the past six years $75,000 in gold, principally in nugget form, ranging in value as high as $744. Rich quartz lodes are believed to exist in the vicinity. These placers are now principally in the hands of Chinamen.

In the *Swauk district* a mountain of quartz has been located and tunneled to the extent of 400 feet, by residents, under the corporate style of the Homestake Mining Company. The Homestake quartz is free milling, assays $10 to $300 per ton, and is well situated for milling, even should it work as low as $7 per ton.

Fifteen miles beyond the Swauk Discovery Bar lies the *Pechastin mining district*, in which quartz mining by arrastras, and later a 6-stamp water-mill, has been carried on after a fashion for the past five years. The quartz, lying in porphyry and slate, assays from $10 to $1,000 per ton, and works in free gold an average of $40 per ton.

The Shaffer Company, owning the 6-stamp mill, has tunnels in its property aggregating in length 4,000 feet, and has taken out not less than $50,000. Until this season the valuable sulphurets have been allowed to go to waste. A Frue concentrator was put up last season and its product will be worked another summer.

The Pole Pick Company took a small mill into this camp late last fall, and, together with the Shaffer and Tip Top Companies, have since been extensively prospecting. During the winter 22 men are employed by these companies. Several individuals own promising locations in the camp, upon which more or less work has been done without as yet establishing their actual value.

Fifty miles from Ellensburg is the *Cle-el-um mining district*, in which prospecting has been carried on to a limited extent during the past three years. Previous to last spring the discoveries were principally gold and silver bearing rock, assaying from $17 to $400 per ton, in about equal amounts. A company of Tacoma (Washington Territory) capitalists has purchased the principal original discoveries and will probably test them thoroughly next year.

After midseason a number of discoveries of undoubted value were made on the headwaters of the Teanaway, Cle-el-um, and Osickle Creeks, fifteen of them upon what bids fair to be a massive lode of copper ore, yielding in the black oxide of copper 8 to 86 per cent.; silver, 2 to 800 ounces; gold (in two instances) to the amount of $140 to $400 per ton.

The Bullion Mining Company, composed of citizens of Yakima County, owns the property, Walter A. Bull and several other individuals having a controlling interest in ten of the claims. The latter combination also controls the other principal discoveries referred to, which are, chiefly, an 8-foot lode in sienite and porphyry, assaying $301.40 in gold and $94 in silver per ton; a 5-foot lode in granite, yielding 175 ounces silver per ton; a 10 to 12 foot lode in bird's-eye porphyry and block-slate, assaying 55 ounces, and $125 in gold per ton. Upon the copper-silver discovery, Messrs. Bull & Co. have had men sinking to the water level during the past winter. Upon the second named two tunnels have been started. A shaft sunk 10 feet brought a fine body of ore in sight. Upon the last-mentioned prospect nature has developed to the depth of 20 feet, a creek having broken through the block-slate foot wall and cut the lode to that depth.

Midway between Ellensburg and the Cle-el-um district, and adjacent to the proposed Cascade division of the Northern Pacific Railroad, coking coal of excellent quality has recently been discovered, which, being easy of access either for shipping or smelting purposes, bids fair to play an important part in the smelting mineral wealth of this section. In addition to thousands of tons of low-grade copper ore in sight in the Cle-el-um district, there is a mammoth magnetic iron lode, which will undoubtedly be worked. The latter assays 80 per cent. and upward and carries both copper and silver. Fine timber and water-power are abundant.

Mr. William Munks, of Fidalgo, Whatcom County, reports that there are no producing mines in that vicinity, although copper is found, but not as yet in paying quantities. He states that the nearest mines are 80 miles distant, on the headwaters of the Skagit River, where, in his opinion, there are only four or five men at work at placer mining, who make small wages, $3 or $4 per day.

As these mines can be worked but a portion of the year the production at the best would not exceed, according to this statement, $3,000.

Mr. E. G. English, postmaster at Mount Vernon, Whatcom County, makes the production of the Skagit mining district from placer mines 75 ounces of gold, valued at $20 ounce fine, $1,500.

In Whitman County, Mr. W. H. Stuart, of Taxsas post-office, estimates the production of the placers in the Snake River mining district or bar diggings, at 100 ounces, produced chiefly by Chinamen."

# CHAPTER XIII.

## *MINES OF THE APPALACHIAN RANGE.*

The mines of North and South Carolina and Georgia have not produced as much by nearly $60,000 as in the year 1882. The falling off in Georgia was about $50,000, and in North Carolina about $45,000, a total loss in these two States of nearly $100,000, or more than one third of their annual production. This, however, was partly offset by an increased production in South Carolina, which came up from $25,000 in 1882 to $57,000 in 1883. These estimates, as well as nearly the entire body of information which follows, were compiled by Prof. G. B. Hanna, assistant assayer of the Charlotte assay office, who personally visited for the purpose most of the mining properties described by him, and whose discriminating judgment entitles his conclusions to acceptance. He estimates the production of the States named during 1883 as follows:

| States. | Gold. | Silver. | Total. |
|---|---|---|---|
| North Carolina | $167, 000 | $3, 000 | $170, 000 |
| South Carolina | 56, 500 | 500 | 57, 000 |
| Georgia | 199, 000 | 1, 000 | 200, 000 |
| Alabama | 10, 000 |  | 10, 000 |
| Total | 432, 500 | 4, 500 | 437, 000 |

## NORTH CAROLINA.

### FRANKLIN, NASH, AND WARREN COUNTIES.

The auriferous territory in the northeastern portion of the State is comprised in Franklin, Nash, and Warren Counties. The principal mines are the Portis, Arrington, Kearney, Taylor, and Mann. They were fully described in former reports, and remain in about the same condition, as during the year they have been idle.

Mr. D. A. Wray, of Ransom's Bridge, writes that the only gold produced during the year was the small amount gathered by the negroes in washing the dirt from the bottom of gullies formed by heavy rains. Occasionally some sluicing was done in a desultory way. The work of the year was so fitful, petty, and scattered that no accurate statement of the production can be made, but estimates made by residents of the counties vary from $1,000 to $2,500.

Some experiments in concentration were made with new apparatus at the Portis mine, but had not advanced far enough to make any production. No important operations are in contemplation for 1884, and this section will, it is likely, lie unproductive until the introduction of systematic efforts to supply large and cheap water facilities.

### MOORE COUNTY.

The mines of Moore County, in the extreme southeastern portion of the gold-bearing territory, were worked less in 1883 than in the two years preceding.

Experiments conducted at the Bell mine were unsatisfactory, but they were too brief to be thorough. An extensive plant was erected in the latter part of 1882 and commencement of 1883. Some of the machinery was unsuited to the work, and the method will not be further employed. It is not likely that any important work will be done in 1884, although the resources of the mine are unquestioned.

At the group of mines northwest of the Bell—the Burns or Alfred, Morrell, Cagle, Clegg or Houston, Shields, Bat Roost, and Brown—less work was done than usual.

The Shields was prospected a little during the summer, and the Clegg was worked at long intervals. Some legal complications kept the Cagle idle till the latter part of the year, when Mr. A. B. Jones, of New York, commenced to unwater it. The machinery had suffered from long disuse, and extensive repairs were needed to place it in a condition for effective work. The intention is to operate the upper part of the mine at points which were disregarded in the past as being unremunerative for the methods then employed. As the mill is provided with ample machinery, there is good reason to anticipate returns equal to those of former years.

The Burns mine passed into the hands of New York parties in 1882, and the early part of 1883 was spent in prospecting its resources, and the production, therefore, was less than that of preceding years. Later in the year the mine changed ownership, and a Parsons crusher and amalgamator was erected. This machine is modeled after the Howland, but with numerous improvements, especially in the amalgamating portion. It was not completed in time to add to the production.

Meanwhile the ore-body continued unchanged in value, although it had been developed to a considerable extent during the year. The property contains more than 250 acres, all of which is auriferous to a greater or less extent. From Mr. Hanna's sampling of more than 1,000 places in the large cut at Moody Hill, near the mill, a result of 87 cents per ton was obtained. Other portions of the property, particularly Brown Hill, similarly sampled gave $1.03. There are zones, however, which go much higher. One in the Moody Cut, sampled in several hundred places, gave $5.17; with ore of this value or that carrying but $3 per ton good work is assured. Like every area of the same character, places will be found, as in Brown Hill, where extraordinary high-grade ore is found, but the quantity is relatively limited; it is quite easy in the Burns mine to select ore channels, which will yield in long-continued work ore ranging from $3 to $4 per ton. With such resources it will be due to mismanagement if the mine does not become a steady producer. The yield of the county in 1883 was $5,000, a portion of which was obtained from ore shipped out of the State to be reduced.

### ANSON COUNTY.

The chief mine is the Mikado, which was formerly called the Hamilton. The property is now held by a Baltimore company, and preparations are being made to reopen at once. There are two veins running across the tract, one of 4 feet and one of 2 feet. The former is of very low grade. The 2-foot vein has been tested to a depth of over 100 feet, and the last one milled gave $13 per ton. The ore is free milling. The mine has a 10-stamp mill, pump, and all necessary plant to begin operations soon.

### MONTGOMERY COUNTY.

In this county but little work was done in 1883, and the mining industry was in a languishing condition. This was partly occasioned by a long-continued summer.

The Sam Christian mine closed operations early in the season, owing to an accident to the dam, and nothing further was done during the year.

At the Beaver Dam mine no regular work was done; small parties occasionally worked the old tailings and some patches of gravel, but the result was small.

At Moore's Mountain mine only prospecting was done during the spring and summer, with insignificant returns.

The Henderson mine was cut by several trial pits; too little of the vein was exposed to justify any conclusions as to its extent or permanence. The ore is galena and copper pyrites, and is unsuitable for any process except smelting.

At the Z. Russell mine the operations were very limited and the yield small.

The Big Russell, on the northern border of the county, was idle.

The Coggins mine, discovered in 1882, was actively explored and milling was commenced in the fall by David Loftin, of Thomasville. The ore-body has been opened to a depth of 45 feet and is a low-grade soft argillaceous schist. There are apparently two zones of schist a few feet apart, and each is from 7 to 10 feet wide; they give evidence of permanency, both in length and depth. The ore is soft, easily mined, and cheaply milled; it is reduced by an old Carolina mill, run by water-power.

At the Saunders mine, the northeast extension of the Steele, a shaft was sunk and at 100 feet depth struck an ore-body, which was not explored, but the shaft was continued to reach the supposed extension of the Steele. The ore so far encountered carries galena, blende, and some pyrites, and closely resembles that of the Steele mine, in which chimneys of extraordinary richness are found. The smelting process is the one best suited to the class of ores found here.

Bunnel Mountain mine, is on the east side of the Uwharie River, near its junction with the Yadkin. It was reopened and prospected to a considerable extent for rich gravel and veins.

The placer work of the county was less than in 1882.

The total production of the county was $4,000.

### STANLY COUNTY.

With the exception of the Crowell mine the mines of the county were idle.

The Crowell was worked only a part of the season.

The Barringer, 4 miles from Gold Hill, was still in litigation at the close of the year.

The Hearn and Heathcock mines passed into the hands of Northern parties, and arrangements are being perfected to reopen them.

The yield of the county was about $2,000.

### UNION COUNTY.

I am indebted to Mr. J. C. Bates, of Monroe, for the following report on the mines of this county:

"The known mines in Union County are the Bright Light, Black, Crowell, Doster, Dismick, Davis, Fox Hill, Howie, Harkness, Hemby, Eli Hemby, Lewis, Laney, Longs, Phifer, Pyron, Henry Phyfer, Starns, Shannon, Stewart, Smart, Washington, Wyatt, Lemmon, Nesbitt, Moore, Dan Alexander, Polk, Greer, Victoria, Pennman.

A large proportion of the above-named mines were worked quite extensively before the war; but for the last twenty years the few that have been operated have been on a small scale. Lack of necessary capital is the principal cause.

Perhaps one-half of these properties, with capital and good management, could be developed into good paying mines. There are probably no great bonanzas in this section, but properties that would pay fairly for legitimate work done on business principles.

At the date of my last report there were negotiations in progress for several mines in this county. The general depression in mining matters for the last year or more has had its effect upon this section as well as upon other mining districts; and the result has been to delay all of the negotiations that were in progress a year ago. Extension of time has been asked for and granted in every instance, and the mines which I believed at last report would soon be in operation are still idle. There is now, however, a fair prospect that whether sales be made or not several mines will be in operation soon.

The only mine in the county worked anything like continuously has been the Bonnie Doon, formerly known as the Crump. The force was small, however, but for the amount of work done the result was satisfactory. The mine has lately changed hands, and is now under bond to Boston parties, who are pushing work vigorously. Heretofore pockets only have been sought for, and many have been found. Thirty-nine pounds of gold are said to have been taken out in one day some years ago. This was all in nuggets, one of which weighed over 9 pounds.

F. Wadsworth, an experienced Western miner, is the present superintendent, and he believes that he can develop a sufficient quantity of milling ore, independent of the pockets, to warrant the erection of a stamp-mill at an early day.

The Harkness mine, near Matthews, has lately been reopened and some ore taken out and milled for testing only. This mine has the reputation of having produced in times past a considerable quantity of rich ore. That now in sight is of good quality and there is a fair prospect of this property being developed into a good paying mine.

In the southern part of the county are the Doster, Pyron, Laney, and some others. They are all of the same character, and were discovered many years ago. Considerable gold was obtained by washing the gravel of the ravines and creeks in rockers. No veins were found, and after a time work was abandoned, and for many years they have been idle.

Mr. Laney has lately found a very promising vein on his property, but has not yet done work enough to prove its extent. From 40 bushels of ore over $100 was obtained by simply washing in a rocker, getting, of course, only the loose gold. Some nice specimens and small nuggets were obtained.

An iron circular mill is now being erected, and in the spring he will test the mine thoroughly, if he can get some one with capital to join him in the enterprise.

At the Howie prospecting work has been done at intervals during the year, and paying ore can now be shown at a score or more of places on the main belt of the mine. This belt is about 400 feet wide and has been worked for half a mile in length. Before the war this mine was worked very extensively by the late Commodore Stockton, of New Jersey. This property is now under negotiation with parties in France.

The same parties are also negotiating for the adjoining properties, viz: Washington, Penuman, and Wyatt. If the negotiations are completed two other tracts may also be joined to those above mentioned, and the united properties called the Grand Union, and will make perhaps the largest mining property in the South.

The Shannon is a continuation of the Howie belt. Several prospecting shafts have lately been sunk, and good ore is shown in three of them. Want of capital is the cause of the discontinuation of work.

The Starns mine is now under bond with a prospect of being opened soon.

On the Victoria two prospecting shafts were lately sunk, but the result was not as satisfactory as anticipated.

The Bright Light is well equipped for practical work, but for the last year very little has been done. Operations will be resumed soon.

The Davis mine has been worked with a small force at intervals and with fair result.

The Eli Hemby mine will probably change hands soon and be opened for legitimate work.

Preparations are now being made to open the Greer mine.

The total product of gold for 1883 for Union County was about $5,000.

## GUILFORD COUNTY.

The mining industry in Guilford County is in a backward condition.

At the Hodgins mine a little surface work was done with a Parsons pan.

In the Lindsay nothing was done except to keep the water down.

At the Fisher Hill mine preparations were commenced to work the *débris* and refuse from former operations; five stamps were erected with the intention of increasing the number should the results achieved be of an encouraging character.

The North State adjoins the Lindsay, and is thought to be on the same vein. Ten stamps were erected, but no underground work was done to supply them with ore; about 1,000 tons of material from the old workings are on the dump.

There does not appear much probability that any of these enterprises will add largely to the product of the county, which yielded in 1883 about $1,000.

## DAVIDSON COUNTY.

The only mines that produced during the year were the Conrad Hill and Lalor.

The Conrad Hill mine came rapidly to the front as a producer of bullion Matting the ore was not found to be economically advantageous, but the works for chemical treatment of the ore—a modification of the Hunt and Douglass process—proved a decided success, and a large amount of cement copper was obtained, while the auriferous residues were returned to the mill. The mill, of 20 stamps, has been remodeled and its efficiency increased. The copper amalgamating plates ordinarily in use have been in part replaced by Moore's wave plate amalgamator, which has proved to be of great utility in saving gold. Comparative runs made with this apparatus and with copper plates, and also assays of tailings resulting from each method employed. show that the wave plate amalgamator is of superior efficiency. The underground work progressed satisfactorily and the vein was found to be increasing somewhat in width. Dodge Hill, north of Conrad Hill, has been acquired recently by the company and is being opened with favorable prospects, showing a large vein of free-milling ore.

At the Silver Valley mine the new shaft was sunk to a depth of 145 feet, where it cut the vein, which was found to be from 3 to 4 feet in width, with ore of the same character as that in the old workings. The company had been shipping their ores to Swansea, but as the returns were not satisfactory, and there being no local reduction works, they allowed the old shaft to fill with water. They are now erecting two double Rittenger tables for concentrating the ore and also to separate the blende from the galena.

The Cid mine yields an argentiferous and auriferous copper pyrites, which requires smelting. It is likely that active operations will be commenced and prosecuted during the coming year.

The Siver Hill mine continues to be idle.

The Smith, or Welborn, as it is sometimes called, closed work in June. The process employed for reduction of the ore proved to be defective and the returns were insignificant. This mine is claimed to possess abundant resources, but it is not known when work will be resumed.

At the Ward mine work was continued during the year, but it was chiefly of a prospecting character.

The yield of the county in 1883 was $49,000.

## RANDOLPH COUNTY.

In this county but three mines were at work during 1883, the Jones, Herring, and Hoover Hill. But little was done at the first two named, and the Jones is now closed.

At the Herring the work was of an experimental character, to ascertain whether by some changes in the method of treating the ore an increased percentage of gold could be extracted, but the results are not known.

At the Hoover Hill mine the condition at the close of 1882 was regarded as almost hopeless, but at the suggestion of the superintendent, Mr. William Frecheville, further exploration was undertaken before the final abandonment. The advice was sound, and the mine immediately entered on a season of prosperity.

The following statement of Mr. Frecheville shows the character of the work and the condition of the mine:

Owing to short supply of ore in the beginning of the year, and repairs on the dam in the summer, the mill made about nine months' full time during the year. The developments in the mine during 1883 have been, on the whole, fairly satisfactory. Work has been carried on at two points—at the Gallimore shaft, and at the Hawkins shaft about a quarter of a mile to the southeast. At the Gallimore shaft a drift has been run at a depth of 130 feet under the Briols old works, where a chute of good ore was reported to have been followed down to a depth of about 100 feet. Good ore was discovered in this drift, which has been followed to a depth of 200 feet, and is looking well in the bottom.

From the Hawkins shaft considerable quantities of ore have been raised during the year, but its occurrence seems to be somewhat more irregular and patchy than on the Briols chute. It is believed that the work for 1884 will be even more satisfactory.

The production of the county was about $25,000.

## ROWAN COUNTY.

In Rowan County the work of the year was small and unsatisfactory.

At the New Discovery mine a full plant of machinery, including a Designolle apparatus, was erected in 1883. The ore, however, was deficient in quantity and difficult to treat, and work ceased toward the close of the year; the greatest depth reached was nearly 100 feet.

The Reimer, the Bullion, and the Yadkin were closed during the year. The buildings and machinery at the Reimer were destroyed by fire about the beginning of 1884, and there is but little hope of good work for some time to come.

The Gold Knob mine did but an insignificant amount of work.

At the Dutch Creek mine a few runs were made, but the work of the year was chiefly of a prospecting character, at what is known as the Copper shaft; in November it had reached a depth of about 75 feet, where the vein ranged from 1 to 4 feet in thickness. The ore is brown iron and copper pyrites. There are six other parallel veins, two on the east and four on the west of the one opened, but too little work has as yet been done upon them to determine their value. The topography of the ground is such that an adit may be run in 75 feet deeper than the present work and the ore be run out by gravity cars on a tramway to the 10-stamp mill.

At Gold Hill the Randolph shaft was unwatered early in the summer to a depth of 750 feet. The Old Field shaft at the same time was sunk 160 feet. The ore from this shaft was principally milled, but that from the Randolph was too highly sulphureted and cupriferous to treat in that way. The exploitation of last summer established the fact that the "Texas shoot" was intact near the bottom of the deep level. This was thought to have been exhausted by the former workers of the mine. Mr. Thomas Price, of San Francisco, made an examination of the property in October last, and from his report it appears that ore from the bottom of the Randolph shaft averaged $57 to the ton; from 600 foot level, $458; reservoir, $290; Brownhardt shaft, $219; Old Field shaft, $20.

The Rowan Mining and Milling Company opened two veins on their tract of 1,600 acres, situated between the Dutch Creek and Gold Hill mines. The ore was found to be abundant, but of low grade. No sulphurets have as yet appeared, as no great depth has been attained. The working plant consists of Beckett and McDonnell's rolls and four Freiberg barrels.

The Dunn Mountain mine was in operation a portion of the year. The superintendent, Mr. J. D. Stewart, reports that the principal work during 1883 was underground, on what is termed the office vein, and consisted in driving levels northeast and southwest from No. 1 shaft on the vein, which averaged about 18 inches in width. The mill work was a three months' test run, during which time about 15 tons were crushed per day. The prospects for 1884 are encouraging, and operations will be commenced in the spring on a large scale, as it is in contemplation to stope ore from both the office and large vein on the hill. About 800 feet of trestle-work have been constructed for conveying the ore from the office shaft to the mill. The Engine shaft on the large vein is similarly connected. It is also proposed to erect a desulphurizing and amalgamating plant for the concentrates, of which a considerable amount is on hand.

The Holtzhauser mine, near Gold Hill, was prospected in the autumn by Pennsylvania parties.

The Davis Chlorination Works, near Salesbury, were not in operation during the year.

The total production of the county was about $5,500.

## CABARRUS COUNTY.

In this county the work of the year was chiefly of a developmental character.

The Cabarrus Gold and Silver Mining Company sunk a shaft 42 feet and ran a level 50 feet; the vein was found to be from 6 to 15 inches wide. Four other veins are known to exist on the property. Work was suspended in August.

The Eureka Consolidated adjoins the Cabarrus ground; but little work was accomplished during the year.

The Neal, formerly the American mine, erected the Tasker pulverizer previously used at the Rocky River mine; little work was done, and at the close of the year the mine was idle.

The Phœnix mine continued to be actively worked. The main shaft reached a depth of 285 feet, but levels had not been run lower than 250 feet, at which depth the chief portion of the ore worked was extracted. The vein at this point is about 2 feet in width, and there is a larger reserve than in 1882. This mine is supplied with chlorination works, which have met the expectations of the company; the percentage of the assay value of the ore that was recovered exceeded that of former years.

At the Tucker mine but little work was done. The shaft is now down 100 feet, and preparations are being made to sink to a depth of 300; the vein is from 16 to 18 inches in width, and carries heavy sulphurets.

The Plattner Chlorination Works, erected in 1882, did not give satisfactory results, and the Mears process was introduced; but three runs were made which showed well.

The Rocky River mine was idle except during the spring months; late in the autumn a 10-stamp battery was erected. There are six veins upon the property, but none have been sunk upon to any great depth. The ore is of good grade and abundant, but evidently is running into heavy, refractory sulphurets. There appears to be no reason why this mine should not be a producer of considerable bullion in 1884.

The production of the county in 1883 was $26,500, which includes the value of gold and silver contained in ores shipped.

## MECKLENBURGH COUNTY.

In this county considerable activity was manifested, and more work was done than in the preceding year. Several small mines which were in operation in 1882 were idle in 1883, but at the larger mines more activity was displayed.

The Baltimore and North Carolina Gold and Copper Mining Company worked for the most part on the south vein; the first shaft sunk was lost in quicksand, and it was only in September that milling was commenced and continued during the remainder of the year with satisfactory results. The ore was a fair grade of brown ore carrying free gold.

The Ray vein was not worked.

The Johnson mine, in Crab Orchard Township, was operated in a small way during the summer and autumn, but the returns were small.

The Rudisil was worked during the whole year. The chief operations were on the south chimney, from which a large amount of high grade sulphurets was extracted and shipped to Newark, N. J., for smelting. The lower grades of ore mined were stored on the dump, as the mine has no milling facilities. The returns from the high grade were satisfactory, and work on the other ore chimneys is likely to be continued.

At the St. Catharine mine extensive underground work was carried on. During the year shaft No. 7 was sunk 100 feet, giving a depth of 260 feet. Three levels were run, at 150, 205, and 250 feet, respectively; the last two were in ore; the vein continued in width, the mineral matter being heavy sulphurets. A drift was run from the 150-foot level, northwest to the cross vein and continued on the vein for 70 feet, which at that point carried brown ore in addition to sulphurets. A 10-stamp battery was erected in the fall of 1883 and was in operation during the rest of the year. The heavy sulphurets were shipped for treatment elsewhere.

The Capps mine was worked with good results during the whole year; the chief operations were at the north end of the 90 and 130 foot levels, but considerable ore was taken also from the Maury shaft. The mineral matter consisted of brown ore of moderate value and high-grade sulphurets. As there are no local facilities for treatment, much of it was shipped to the Designolle works, near Charlotte. A large amount of ore remains on the dump and in the stopes ready for extraction.

The Arlington Guarantee mine was worked in a desultory manner during the early part of the year and reached a depth of 90 feet, but only a little milling was done and the mine finally was allowed to fill with water. In October the property changed hands, was unwatered, and preparations made to recommence work.

The Designolle works, 4 miles south of Charlotte, were in operation most of the year, but the method of reduction employed was not entirely satisfactory for the sulphurets found in that section of country, and the returns were but moderate, although a full supply of ore was at hand. Experiments are being made to overcome the difficulties encountered in the way of reducing the refractory ores.

The individual operations of the county were less than in preceding years.

The total production of the county was $30,000.

### GASTON COUNTY.

In this county mining work was nearly at a standstill.

The Kings Mountain mine was run at intervals during the year, but only a small part of its extensive plant of machinery was in operation. Some new amalgamating machinery was erected and used for a short time by a Chicago company.

The placer and small work was confined in the vicinity of Kings Mountain and Burrell Wells, and was insignificant in character.

The product of the county was $3,500.

### LINCOLN COUNTY.

No mining was done in Lincoln County during the year.

### CATAWBA COUNTY.

The principal operations in this county were at the Shuford mine, of which Mr. F. W. Dygert reports that there was no addition made in the way of machinery to the plant during the year, as the prospect in the 65-foot shaft did not warrant paying for the extra expense of purchasing the necessary outfit for sinking below water-level. The pump was run twelve hours a day concentrating, up to August last, which furnished ore for the mill and supplied water for milling, since which time ore has been taken from a stringer or gash vein 3 inches in width, which was uncovered by washing. When this failed to supply ore in quantity to keep the mill running twelve hours a day, tailings were stamped that were saved at the end of sluice boxes when sluice washing; of these there is a large supply on hand. There are 500 tons of tailings on the dump, and as many thousand in silt dams, which, with a suitable mill, can be worked at a handsome profit. There was a 12-foot face where the vein was uncovered, and the present work is an incline going into the hill 100 feet, with a vertical depth of 55 feet from the surface. The quantity and quality of the ore is increasing as it goes down, and from present prospect there is reason to expect a good season of milling in 1884.

Three-fourths of a mile southeast of the Shuford is the A. D. Shuford mine. Some prospecting was done here early in the year, but was not followed up with extended operations.

A little placer work was done in several parts of the county, but the results were insignificant.

The entire product was about $4,500.

## POLK COUNTY.

The Double Branch and Splawn, in the vicinity of Sandy Plains, were the only mines at work during the year.

At the Double Branch the supply of ore was not so great as in 1882, and this, together with deficient water, considerably lessened the yield.

The Red Spring mine, about a mile northwest of the Double Branch, has two or three veins, but none were worked to any considerable depth, although the ore is of a fair milling quality. It was reduced at the Collins mill.

The Splawn mine, 2½ miles west of Sandy Plains, and on the east slope of Splawn Mountain, has a well-defined vein well situated for exploitation; the ore is free and easily milled, but of low grade. The mill is situated near Sandy Plains, and the cost of hauling the ore was too heavy for its profitable treatment, and after a short trial the enterprise was abandoned.

The Smith mine, half a mile east of the Double Branch, was operated for a few weeks with unimportant results.

The veins of Polk County are usually narrow seams, frequently not more than 1 inch in width, but generally of good if not high-grade ore, which is friable and easily treated. As the product under any treatment of the ore can be but limited, the use of heavy and costly machinery is precluded, and something cheap, light, easily erected and operated, is a necessity. This has been met by Mr. Benjamin Battington, a founder at Shelby, who has invented a light battery which does effective work. The mortar weighs 640 pounds and each of the 5 stamps 160 pounds. The iron work costs $70, and the wood work from $25 to $50. The total cost of the mill, building, water-wheel, &c., was, in one case, but $480. Although apparently insignificant in character, these mills fully meet the requirements of the mining industry.

The production of the county was about $1,500.

## BURKE, M'DOWELL, AND RUTHERFORD COUNTIES.

The mining industry of these counties declined during 1883. This was owing in some measure to the long-continued dry weather of the summer, but in a greater degree to a growing tendency on the part of the mining population to abandon mining and turn their attention more to agricultural and mechanical pursuits.

The Vein Mountain mine, in McDowell County, added but little to the production of the State, and the Hard Bargain tract was idle on account of litigation.

The Hancock mine, in Burke County, was constantly at work, and the result was about the same as that of the preceding year.

The Carolina Queen, in Glen Alpine, was divided early in the year. The vein part of the property was sold, and received the name of the Little Princess, and a 5 stamp mill was erected. Subsequently, the Carolina Queen, Glen Alpine, Soapstone Hollow, and Little Princess were consolidated. Placer work stopped early in the spring, and the mill was run but ten days.

At Brindletown, in Burke County, J. C. Mills has continued work; the water supply was larger and the returns better than during the preceding year. Operations were principally in a gulch leading into Pilot Mountain, which has been worked about 100 yards during the last two years, and there remains about 600 yards before the head is reached; the channel varies from 30 to 100 feet in width. The whole property of 2,600 acres is gold-bearing, but the water supply is too small for thorough work; a ditch has been surveyed to bring a larger amount from the French Broad River through the Hard Bargain Gap, 2 miles northeast, by which a pressure of 360 feet can be obtained. The ditch would be about 15 miles in length.

At the Grayson mine, in Rutherford County, work was suspended in May owing to the failure of the process that had been introduced for the treatment of the ores.

The Gamble mine did not commence operations until autumn, and but little work was accomplished.

The production of these three counties was about $20,000.

## CALDWELL COUNTY.

In this county mining was prosecuted in an exceedingly desultory manner, and the yield for the year did not exceed $500. In the section of country west of the mountains considerable interest was manifested in mining operations, but the actual work performed did not keep pace. Only placer mining was attempted; the total product did not exceed $5,000.

The following is a list of the mills and reducing machinery in North Carolina at the close of 1883: Portis mine, 5 stamps; Shields mine, 1 Chilian mill; Cagle mine, 20 stamps; Clegg mine, 10 stamps; Burns mine, 3 Chilian mills, 1 Parsons battery; Bell mine, 1 set rolls; Hamilton (Anson County), 10 stamps; Harkness, 1 Chilian mill; Davis, 2 Chilian mills; Bright Light, 15 stamps; Saint Catharine, 10 stamps and 4 Chilian mills; Baltimore and North Carolina, 10 stamps; Faries, 10 stamps and 1 Chilian mill; R. McDonald, 1 Howland battery; Johnson, 1 Chilian mill; Todd, 1 Chilian mill; Designolle works (Charlotte), 10 stamps; Arlington Guarantee, 3 Chilian mills; Maxwell, 10 stamps; North State, 10 stamps; Hodgins Hill, 1 Parsons battery; Jones, 10 stamps; Herring, 1 Howland battery; Winslow, 10 stamps; Hoover

Hill, 20 stamps; Silver Hill, 10 stamps; Silver Valley, 20 stamps; Conrad Hill, 20 stamps; Eureka, 10 stamps; Lalor, 10 stamps; Coggins, 2 Chilian mills; Big Russell, 10 stamps; Crowell, 5 stamps and 2 Howland batteries; Gold Hill, 20 stamps; New Discovery, 15 stamps; Dutch Creek, 10 stamps; Atlas and Bann, 1 set rolls; Dun Mountain, 10 stamps; Reimer, 1 set rolls; Gold Knob, 5 stamps; Phœnix, 10 stamps; Tucker, 10 stamps; Quaker City, 5 stamps and 1 Chilian mill; Rocky River, 10 stamps; Neal, 1 Tasker pulverizer; Shuford, 5 stamps; Carolina Queen, 5 stamps; Grayson, 5 stamps and 1 pan; Double Branch, 5 stamps; Splawn, 5 stamps; Kings Mountain, 40 stamps; Long Creek, 10 stamps. There are also 3 chlorination works and 2 Designolle works for chemical treatment of the ores.

*Summary of the production of North Carolina.*

| | |
|---|---|
| Nash, Warren, and Franklin Counties | $1,000 |
| Moore County | 7,000 |
| Montgomery County | 4,000 |
| Randolph County | 25,000 |
| Stanly County | 2,000 |
| Union County | 6,000 |
| Guilford County | 1,000 |
| Davidson County | 50,000 |
| Rowan County | 5,500 |
| Cabarrus County | 26,500 |
| Mecklenburgh County | 29,500 |
| Gaston County | 3,500 |
| Catawba County | 4,500 |
| McDowell, Burke, Rutherford, and Caldwell Counties | 21,000 |
| Polk County | 1,500 |
| Cherokee and Transmontane region | 5,000 |
| Total | 193,000 |

This amount includes shipments of ore from the State, which contained $20,000 of gold and silver, of which the silver amounted to about $1,000. That in the gold produced was about $2,000, making a production from the State of $190,000 gold and $3,000 silver.

In his detailed statement of production, Mr. Hanna reduces the above amount to $170,000 including the ores shipped abroad for reduction, and I have adopted the latter estimate as being approximately correct and placed the production of North Carolina in 1883 at: Gold, $167,000; silver, $3,000; total, $170,000.

## SOUTH CAROLINA.

In South Carolina the mining industry was in a prosperous and healthy condition during the year 1883. There was less speculation and rash mining and more general attention paid to the prosecution of legitimate work.

At the Dorn mine, in Abbeville County, nothing of importance was attempted.

In *Spartanburgh County* the Jackson mine, situated 6 miles southeast of Lardrum, was worked at intervals, as also was the Hammet, but neither of them added much to the production of the State.

In *Union County*, 1 mile east of the Spartanburgh line, is the West mine, which was opened in 1882 and commenced milling in the spring of 1883. The shaft is down 100 feet, all in ore, but most of that extracted was from the 50-foot level. The mill contains 20 stamps, and the production of bullion for the time it was in operation was satisfactory. Mr. R. S. Hopkins is the superintendent.

The Posy Hill works, belonging to the same company, are a short distance south of the West mine. A large amount of ore was extracted in former times, as is evidenced by the size and number of excavations. It was taken out of open cuts, but now the mine is worked by shafts and tunnels. There is an abundance of ore, but it is of lower grade than that taken out in the early days of the mine. The ground to a depth of 50 feet is broken, but at 100 feet is firmer and less stained with oxide of iron. The entire formation is much altered and is very silicious, resembling somewhat laminated sandstone, but this character is apparently the result of alteration. As a rule the masses are lenticular and sometimes cut off squarely by "heads." Iron pyrites is finely and sparsely disseminated throughout the entire mass. The ore channel is sometimes 10 feet thick, but it is frequently difficult to distinguish the ore from the barren portions by external appearance, for even the nonproductive layers carry some gold. The ore is abundant, but generally of low grade; the production, however, is likely to be steady.

The Thompson mine is one-half mile northwest of the West, and is worked by Mr. W. F. Thompson. The ore body, like that of the West, might properly be called a quarry. At one time it was worked to a depth of 130 feet, but the ore is now taken from the more shallow points. The mill, which contains 10 stamps, is situated about one-quarter of a mile west of the mine, and is connected with it by a tramway. It was in operation only three months in the latter part of the year. Placer work in Spartanburgh and Greenville Counties was retarded by the drought of 1883, and the total result of operations was not over $1,500.

The Magnolia mine, in York County, 12 miles southeast of Black's Station, on the Atlanta Railroad, was worked but little during the year on account of legal difficulties in which the owners had become involved. The property was sold in December, and the purchasers are making preparations to push work vigorously in 1884. There are seven veins on the property. The Spring vein, which carries some copper pyrites, is at least 10 feet wide, with a pay streak of 2 feet. The Seacrest vein, 8 feet wide, is opened by an adit of 130 feet in length. The other veins are the Side Hill, King, Northey, Girty, and Magnolia. The work thus far done has been on the Spring, Seacrest, Girty, and Magnolia veins. The general character of the ore is quartz, much jointed and stained by peroxide of iron. It is abundant, but generally of low grade. The mill is equipped with 10 stamps, and the entire property is in condition to make a steady production of bullion in 1884.

The Wilson mine, also in York County, was opened late in the year, but the work was only of a prospecting character.

The Funderburke mine, in Lancaster County, was prospected to some extent, but no production was made, as the mine is not supplied with machinery for reduction.

The Haile mine, 13 miles east of Lancaster, was worked with more system and energy than any other mine in the State. The mining property comprises 1,805 acres. Successful work was done at this mine in the early and prosperous days of mining in Carolina, while the nature and extent of the ore allowed easy work, but it languished for a generation, during which period the ore changed. Enough, however, was shown to indicate the presence of an abundance of low-grade material.

The auriferous formation extends beyond the limit of the property, and cannot be less than three to five miles in extent, most of which will pan gold, though it is not always rich enough to work in the present condition of the gold industry. With so large an extent of auriferous beds the mining for a long time consisted of quarrying, and much ore was wasted by the rude methods of treatment. Open cut work is still employed, but in some few cases underground operations have been undertaken. The work of the year has been chiefly prospecting, the machinery being established rather to prove the mine; nevertheless the yield of 1883 was quite large for the section.

The demands for ore having exceeded the capacity of the "Old Big Pit," which had been excavated to a depth of 50 feet, the other parts of the property were prospected, and a large mass of equally valuable ore was found adjacent; this was the chief source of the ore supply for 1883, and was worked for a length of 75 feet, a width from 35 to 50 feet and a depth from 25 to 75 feet, without any apparent diminution of its auriferous contents. The breast of ore now worked is at least 60 feet wide, and most of the material is fit for the mill. There is little doubt but that it will be permanent in depth, as a shaft was sunk near by and levels driven from it 30 feet under the floor cut in several directions, and always in auriferous grounds. In October the north level had reached a point nearly abreast of the head of the cut. The average value of the ore from this cut, as taken from month to month, was stated to be from $7 to $11 per ton. The numerous pits to the north of this cut indicates that very good material is to be found still further in that direction, and point equally to permanency and value. About one-fourth of a mile to the west another extensive series of excavations have been discovered. Here the Blanvelt vein has been sunk to a depth of 57 feet, when a mass of ore 25 feet thick was found, assaying almost as high as the figures mentioned above. So far as practical work is concerned the ore supply may be regarded as sure, and the resources of the property ample to sustain several mills. The ore is mostly low grade, but a large part of the gold is apparently free. Both mining and milling are easy and cheap. At present the ore is quarried out by steam drills, thrown into cars and placed in the mill without any further handling. The reducing plants consist of 20 self-feeding stamp, with a "Designolle" work for the treatment of the concentrated and sulphureted tailings. The sulphurets are roasted in a 2-hearth reverberating furnace, with a capacity of from 6 to 8 tons per day; from this they pass to the amalgamator, thence to the settlers. The amalgam is recovered by familiar methods. At first iron cylinders, similar to the Frieberg barrel, were used; latterly a pan was found more expeditious and economical, securing a higher per cent. of gold. This recovery adds a large per cent. to the entire product.

The Walker furnace has been undergoing an experimental run. It has 15 coils of 10 feet diameter of 6-inch iron pipe, into which the pulp is forced by a considerable pressure with air and steam. It is thought capable of treating 15 tons per day, but the experiment was not sufficiently advanced to show its full capacity; the roast was unusually thorough.

About the close of the year a contract was made to supply the mill with ore, and at the same time to store up a reservoir dump at the rate of 2,000 tons per month, at a mining cost of 60 cents per ton.

The following information is furnished by J. C. Bates:

*Chesterfield County.*—The only mine in the county which has been in operation during the year is the Brewer; although this mine has an immense body of ore, since the reopening of the mine several years ago the placer only has been worked. An opening was made in the ore-body several months ago, but the expectations of the owners were not realized. They thought the ore was soft enough to work by hydraulic, but it was found too hard to be worked economically with the pressure to be obtained with the present plant. A return was made to the placer, and this has been worked continuously during the year, and with satisfactory results. Regular monthly deposits of bullion have been made from the mine in the Charlotte assay office. This valuable property is now owned by E. Motz, who is himself superintending the mine. He is a Western miner of long experience, and is pushing work vigorously. He labors under the difficulty of lack of capital, and his plant is far too small for the capabilities of the mine. Properly equipped, and with sufficient working capital to properly develop the mine, Mr. Motz would make this one of the largest-producing mines of the South.

The production of the State in 1883 was $57,000, of which probably less than $500 was silver. The reducing machinery in South Carolina at present is shown below: Thompson mine, 10-stamp; West mine, 20-stamp; Magnolia, 10-stamp; Haile's mine, 20-stamp, 3-pan.

## GEORGIA.

The mining industries of Georgia were in a very depressed condition during the past year. This was due to a variety of causes. Some of the most valuable properties were involved in tedious legal troubles, while financial difficulties impeded others. The chief hindrance, however, was the prolonged drought, which proved even more severe than that of 1881, and as the opening of mines increased in a greater ratio than the ditch facilities, the mining industries became deranged from the want of that indispensable agent to rapid work, water. Eight new mines were opened, while work was closed on about the same number; but for the most part those lately opened are more promising than those closed. In other respects the work was vigorously and skillfully pushed. There is also everywhere a disposition to save in the petty economies of every department, and a still more marked tendency to improve the mill arrangements for saving gold.

*Rabun County.*—In this county, in the northeast part of the State, there has been almost a cessation of work. In 1882 the Smith mine was at work, and at the close of the year was in a condition to have given a steady and large return, but unfortunately the expiration of an option, and the giving of a second, led to legal troubles, and only one run was made during the entire year. It was stated late in December that the difficulties had been settled, and that the mine would be put to work. The mill is furnished with 10 stamps. No important work was undertaken in this county in 1883, and the petty work in vogue in past years was largely discontinued. The production was not more than $2,500, an amount probably not one-third as large as usual.

In *Habersham County*, next south, and out of the better-known belt, the work was even more restricted. The produce of both counties for 1883 could not have been more than $5,000.

In *White County*, to the southwest of Rabun, and on the same belt, the work was also in a backward state, partly from the lack of water as previously indicated. This county was the scene of the operations of two large English-American syndicates, having for their aim the consolidation of all the larger and more valuable mining tracts. The large expectations excited in the owners or lessees of these mines led to a considerable diminution of work.

The minor work, known locally as "gouging," was about the same as in past years, except when the scarcity of water prevented operations. This work was done almost exclusively to the northeast of Nacoochee, and within half a dozen miles. The amount thus produced was possibly $10,000.

The mine of J. B. Dean was one of those involved in the operations of the syndicate, and work was stopped on it early in the year. The same may be said of the Nacoochee mine, though the accidental death of the president of the company, Dr. Curtis, in England, may have been an element in causing the stoppage. The work on the Lumsden lots was similarly affected. The Thompson lots, near the residence of the Lumsden Brothers, were abandoned near the end of 1882, and the Bradley mill remained closed.

Johns & Co. made but a brief run early in 1883. The Jarrett lots Nos. 23 and 24, in the third district, are valuable property with large resources, and have been regarded by the old miners of the section as among the most valuable property of this section. They were reopened for mining work in the spring of 1883, by the Messrs. Childs & Nickerson, of Athens, Ga. Some legal complications prevented the energetic prosecution of the work on the plan originally contemplated; the production, therefore, was not large. It is proposed to erect a stamp-mill, though as yet only hydraulic work has been done. One of the syndicates to which allusion was made has made large conditional purchases near Nacoochee.

I think the promoters had formed no settled plan of putting this large area to active work; there seemed to me no probability that any important part could, under any probable circumstances, be put to its full capacity immediately. The choicest mining ground is involved in the operations of this company, which from the very earliest days of gold mining has been very productive, and which is capable of furnishing a great amount of gold for generations. The other syndicate alluded to is at work to the northeast of the territory above described, and has extended its work into Rabun County, and almost to the South Carolina line. It is, so far, in its early stages, and no exact statement of its probable results can now be given.

The Loud Hydraulic Hose Gold Mining Company have worked in the vicinity of Loudsville and of Pleasant Retreat. The lots worked by this company were 11 in number, viz, Nos. 35, 38, 39, 40, 41, 54, 56, 57, 65, 66, in the first district, and No. 71 in the fourth district; the part which commonly goes under the name of the Loud Gold mine is on lots 54, 35, 39, 40, and 41, first district. These lots, however, were only partly owned by the Loud Hydraulic Hose Gold Mining Company, and were sold in December, 1883, for division. I am not able to say what course the latter company will take with their remaining lots, neither the disposition to be made by the purchasers of lots 54, 35, 39, 40, and 41. The production of this company was considerably restricted by the legal troubles arising from the steps preliminary to the sale, as well as by some complicated questions involving water-rights.

The Blake Company, with a 20-stamp mill, is operating lots 3, 22, 26, and 46, fourth district. Both companies employ hydraulic methods largely, and will continue their work. From the neighborhood of Pleasant Retreat southwest into Lumpkin County there is but little indication of mining work until the Chestatee River is crossed.

The Garnet mine, so called from the great abundance of garnets met with in the work, is on the west bank. The reopening of this mine was undertaken in 1882, and the work of construction was completed, and hydraulic operations commenced in September, 1883. The property comprises 1,500 acres of the old Logan estate; the cut is on lot No. 350, and the mill on 355, first district. The abundant power furnished at this point by the Chestatee has been utilized, not only in operating the mill, but also in elevating the needful supply of water for hydraulicking to the top of the hill, 320 feet to the reservoir, thence to the cut for sluicing. The mill is provided with 20 stamps, and has foundations for 20 more. The lifting is done by a Blake pump, like that at the Calhoun mine, and is guaranteed to lift 100 miners' inches to a height of 300 feet. The sluice line from the cut to the mill is 4,000 feet long, and, having a fall of 220 feet, is adequate to a thorough pulverizing of the ore. The mill was started September 1.

The Findley mine was idle the whole year. The Singleton Gold Mining Company had worked during the year on the Lockhart lot. The old Singleton mill was sold to the Ralston Branch Company, but at the same time a contract was made for 10 additional stamps, making the full number of stamps the same, viz, 25; 20 stamps are in the new mill-house, and 5 in the old one, but the latter are so worn as to be incapable of doing good work. Ten stamps were kept in operation most of the time from the commencement of March. This company uses 10 inches of water from the Hand Ditch Company, but gets much less than this, particularly in the dry weather of summer. The entire work on the Findley Ridge, the Bast excepted, was in an unfavorable condition during 1883. A plan had been proposed to unite the Columbia, lot 988; the Findley lots, 1047, 1048, 1087, 1088; the Bast, 1035; the Lockhart, 1050; the Preacher, 995; the Singleton lots, 1050, 1051, 1084, 1085; and the Griscomb, 996, under one management, and run the whole material mined to the Lockhart mill; the distance from the Columbia, which is the more remote of the mines, is about 1¼ miles, while the Findley is only one-fourth of a mile distant.

The superintendent of the Singleton Company pronounced it quite feasible. This plan of exploring would greatly facilitate work, and lessen the cost in every respect. The Bast, of the consolidated Georgia, did its usual work in 1883, and was, if anything, in a better condition at the close of the year. Its product is merged with that of the Ivey, both being under the same company.

The Columbia mine has the lots 1037, 1038, 1046, 1089. The purchase of lot 988 presented a hope of a period of probable activity, but this hope so far has been frustrated by the unfavorable nature of the formation intervening between the new mining ground and the mill on lot 1089. The great elevation of the ore body on the Findley Ridge compels the lifting of the water from the Hand ditch by pumping engines.

The Calhoun mill is on the whole the finest equipped in this section. The mining work fell short of the anticipations at the start, and toward the end of the year the mill was shut down. The gulches on the east part of the property were subsequently explored, and sluicework somewhat enlarged the yield, while the veins, of which several were uncovered, were reserved for subsequent treatment in the mill. The mill was to have been started up the last week in December; the last clean-up was larger and more satisfactory.

The Keystone property had but a brief career when operations were entirely suspended; the property and rights of the company were attached by the sheriff and advertised for sale on November 29.

The Fish Trap, in December, was working in a cut recently opened; the ore channel was 75 feet wide, and the ore very soft; the appearance of the cut, both in quantity and quality of ore, was unusually good; its value was evidenced by its increased yield. The work in the early part of the year did not come up to its promise in 1882, and for some time was in a languishing condition; the new cut was opened in the summer of 1883, and the work has progressed with efficiency. Milling was carried on about five months.

At the Ivey, of the Georgia Consolidated, 1½ miles southwest of Dahlonega, extensive changes were made in the direction of increased yield and greater economy. For some years the mine had been operated by 20 stamps, and supplied with water from the Hand ditch. In 1882 a ditch from the upper waters of Cane Creek was run out, and opened in 1883; this water supply is sufficient to operate the mill, and to use for piping down the ore. The drought prevented its general and large use until late in the season. At the same time a new mill with 60 stamps (including the 20 in the old mill) was erected further down the gulch. The old cut was opened at right angles to the ore channel, and at such a point as would allow of getting into it at a depth of 50 to 75 feet below the bottom of the old cut, thus vastly increasing the available ore resources. Milling was continued in the old mill until the middle of August, and was resumed in the new mill early in September, though only a part of the stamps were run constantly. The mill is operated by a Leffel turbine, using 60 inches of water with a pressure of 180 feet. Auxiliary steam power is at hand for emergencies, capable of running 20 to 40 stamps. The mine looked in excellent condition. This mining company, including the Ivey and the Bast, has been managed with great prudence and energy, and with a greater yield than any mine in the section. The following dividends were declared in 1883:

| | Aggregate. |
|---|---|
| January 25, No. 21, of 4 cents per share | $4,000 |
| February 23, No. 22, of 4 cents per share | 4,000 |
| November 29, No. 23, of 4 cents per share | 4,000 |
| April 30, No. 24, of 4 cents per share | 4,000 |
| May 31, No. 25, of 4 cents per share | 4,000 |
| July 24, No. 26, of 4 cents per share | 4,000 |
| October 10, No. 27, of 2 cents per share | 2,000 |
| Total | 26,000 |

The following is the annual report of the company, June 1, 1883:

RECEIPTS.

| | |
|---|---|
| Proceeds of bullion, Bast mine | $22,482 11 |
| Proceeds of bullion, Ivey mine | 38,289 64 |
| Dividends on 13,130 shares treasury stock | 5,877 20 |
| Treasury stock sold to pay for right of way of new ditch | 1,000 00 |
| Balance June 1, 1882 | 199 38 |
| Total | 67,848 33 |

DISBURSEMENTS.

| | |
|---|---|
| Expenses, Ivey Bast mine | $9,932 87 |
| Expenses, Ivey mine | 10,022 24 |
| Construction account, Ivey mine, including right of way of new ditch | 1,775 97 |
| Office expenses | 1,847 69 |
| Dividends | 44,000 00 |
| Balance June 1, 1883 | 267 56 |
| Total | 67,846 33 |

The superintendent's report of same date states the company built, in 1882–'83, 17 miles of ditch from the head of Cane Creek.

The Barlow mine was not kept up to its full work by reason of the short supply of water, and at the end of the year had not resumed its customary work. The ore cut showed to increased advantage.

The Pigeon Roost mine, one-eighth mile south of the Barlow mill, was at work only the latter part of the year, but the resources of the mine as developed were not large enough to allow a large yield. The same drawbacks pointed out in the report for 1882 still exist to a great extent, though there is little question that the ore is as abundant and rich as on the adjacent Barlow. At present work is done in the Ogle cut on a body of ore claimed to extend through the entire property.

A new enterprise was started in the fall of 1883 to the southwest of the Barlow and on the same belt; this mine is properly a part of the Barlow, but is separated from the present work nearly one-half mile, and under its present management is practically a new mine. The statements respecting character and quantity of ore given in the description of the Barlow in this and previous reports indicate sufficiently well the nature of the ore supply. The yield to the close of the year was small, but is certain to increase largely. The mill has 20 stamps. The small mining in the eastern part of Lumpkin County is on the decrease, partly because the field is now so largely occupied by the large mines that there is little opportunity for such work, and chiefly because wages have now risen to such a point that it is more profitable to engage in day labor at the large mines. In the continuation of these belts about Auraria the work was in a very unsatisfactory shape during the entire year.

The Chicago and Georgia was rearranged, both mill and cut. The mill was placed further down the gulch, and increased to 20 stamps; the cut was opened near the mill. There was no change of importance in the appearance of the ore, but the facilities for mining were largely increased, and on a lower level than the previous work so as to command a much larger amount of material; the cost of handling has been reduced by these changes. The preparatory work was finished about August 1. Fifty inches of water are used from the Hand ditch. The yield was small.

The Auraria mine was not worked during the year. Work at the Danae was very fitful and the production of little importance. The future, I fear, is not promising, for the sheriff of Lumpkin County advertised it for sale on November 29, to satisfy its debts. The Wells gave such refractory ore that the mill treatment was useless, and the work was stopped.

The operations at the Bell were discontinued early in the spring of 1883.

At the Chestatee or Smith mine, 2 miles southeast of Auraria, the water supply was proven to be entirely inadequate, and would have been so had the season been favorable in this respect. The cut opened in 1883 afforded nearly the whole supply for the year. Late in the season a cut of unusually good material was opened one-eighth mile west, but it was entirely beyond the reach of pipes. Heretofore the water has been used from the Dahlonega Ditch Company, 50 inches at 75 feet pressure; but lately a branch has been run from the Hand ditch, which affords a supply of 50 inches at 140 feet pressure, and allows of piping at a considerably greater elevation, so that a much larger amount of material is thus reached.

The only regular placer work in this vicinity was conducted at the Little Daisy, but the return was not large.

More small mining, or gouging, was carried on in 1883 than for several years. One firm at Auraria purchased $4,000 of bullion, and others were large buyers. I judge that the amount of this work about Auraria reached $10,000 in 1883. The number of stamps in Lumpkin County in 1883 was 440, against 370 in 1882. The rate of increase was not so great as in 1882.

The yield of Lumpkin County from every source I believe to have been $122,500 in 1883.

In Dawson County, on the southwest extension of the Lumpkin County belts, very little work was done.

The Cincinnati consolidated mines were idle, contrary to the general belief, for the completion of their large ditch gave an abundant supply of water for any probable amount of work.

The large ditch of the Kinmori mine, operated by a Cincinnati company, was completed in 1883; this ditch takes 1,000 inches of water from Nimble Will Creek, on the upper part of the Etowah River, 18 miles distant; the ditch line is 34 miles long, and will deliver 600 to 700 inches of water at a pressure of 286 feet. The property of this company embraces 21 lots of 40 acres each. There are seven veins on it, known locally as Big Sulphur, Crawford, Herndon, Johnson, N. McGuire, Quarter, and Roe. The Etowah River runs through the lots, with a decided bend. The land is finely diversified, and abounds in gulches leading up from the river; one of these is three-fourths of a mile long, and several have a length of one-fourth mile. The parts of the gulches adjacent to the water were worked out more or less thoroughly a long time ago, but the more elevated and distant parts have apparently large areas of good gravel, quite easily treated by the hydraulic method. Several gulches are likely to be worked soon in such a manner as to expose several of the veins which cross them, and which enriched them, thus accomplishing the double purpose of remunerative work and exploration. A novel feature of the immediate work is the employment of the Hendy hydraulic lift. Colonel Anderson, the superintendent, spent a large part of the summer in California, studying the details of its application, and concluded that there was an ample field for its use in Georgia. This apparatus is capable of lifting from a lower to a higher level by means of a current of water running through a pipe, *e. g.*, lifting tailings from below the level of an adjacent stream and discharging them into the stream.

The mechanical principle made use of is that a powerful current of water flowing through a pipe produces a partial vacuum, into which is sucked the *débris* of mining from a conveniently arranged sump.

The Etowah River was, during the summer of 1883, diverted from its old channel for a distance of 2,000 feet, and the old bottom put into a condition for treatment. As several rich gulches lead to this part of the old stream, a large return is expected. The abundant supply of water for the first time allows such a method, for something more than one-half of the large head will be expended in lifting the gravel from the sump formed at the lowest point of the old bed. It was a favorite way in the palmy days of mining to divert a stream, but frequently without success. Latterly the Leroy Stone method was tried on the Chestatee, but without uncovering the bottom. Other plans have been tried, but none have had more than partial success. One difficulty is evident, viz, that the bottom is hidden from sight, and from anything more than partial exploration, and when exposed is often found to be barren, the physical characteristics not being such as would catch the gold borne down by the current. With the bottom uncovered, as in this case, and apparently prospecting well, the chances for success, are better. The product from this particular operation is but a part of what may be expected as a whole. If this experiment be worked out successfully a very large extent of valuable ground will be available for hydraulic work which now is unworkable because lying too low for removal of the tailings.

The yield for this county for 1883 was about $5,000.

Six miles southwest, in Forsyth County, is the Dr. Charles mine, of twelve lots, situated for the most part on the west side of the Etowah, and with a fine mill-site on lot No. 68, third district. Nearly all the work had been done preliminary to the installment of the machinery. The outcrop of the veins, six in number, have been cut at intervals of several hundred yards on the crown of the hill; the thickness of rock here is 2 to 8 feet, and occasionally swelling out to a width of 20 feet. They were regarded by Dr. Charles as a continuation of the Findley sand belt. At the foot of the hill, 250 feet below the outcrop, an adit had been driven 1,500 feet, cutting the veins at right angles. The quartz almost from the start is rich in arsenical pyrites, and is evidently a refractory ore; but Dr. Charles expressed no fear of treating this successfully, as he thinks he has a certain method of dealing with such refractory material with advantage. The veins in the adit were not visible, as a cave-in of the roof had choked its mouth up and temporarily flooded it. A dam across the Etowah River was nearly constructed. The mill-house (to be connected by a gravity tramway with the adit) was finished, and 20 stamps were contracted for. The site was admirably chosen for enlargement *ad libitum*. The mining and mechanical arrangements were good. Dr. Charles estimates that the ore will mill $6 per ton; if he be correct in his opinion the success of his undertaking is assured.

The Franklin and McDonald mines are 1½ miles southwest, in Cherokee County, and were worked a little in 1883 by Col. A. H. Moore, who describes the work as follows: "We have been prospecting only for the last two years, but are so well pleased with our property that we are now commencing work in earnest, and hope soon to have a considerable mill in operation. In our exploration of the old workings ore enough was taken out to run an average of 7½ stamps fifty-four days of twenty-four hours each. The ore was from what is known as the Franklin vein, and runs from 4 feet to 24 feet in width, being less concentrated and more decomposed where it is largest. East from the shaft towards the river the ore is raw, showing no signs in the vein of decomposition. The foot wall is hard, and the hanging wall is very soft for a few inches next the vein. Although the raw ore shows no gold in the pan, it paid best in the mill. Just half a mile northwest from the Franklin vein stands the old mill, upon another gold-bearing vein of the very extraordinary width of 200 feet. In this great vein of low-grade ore we have never been able to find a barren spot. It is a finely laminated quartzite, with fine pyrites of iron running through all the seams. The entire mass for a length of more than 10,000 feet has a milling value of an average of $1.60 per ton of 2,000 pounds, and can be mined and milled for 40 cents per ton. The other veins of this mine have not been explored since Dr. Shephard's survey, about 1858. His report gives a number of good-sized and rich veins, which this company has not yet prospected. Preparation is being made here to drain the mine by water-power, the water being brought about 2 miles in a flume. The hoisting will be done by steam-power, but the mill will be run by power taken from the Etowah River. An iron tramway will carry the ore from the old Franklin vein to the mill, 2,600 feet, and we expect the output to be 120 tons daily." The yield was very good for the time devoted to milling work.

At the Strickland, 3 miles southwest, no work was done in 1883.

Of other localities operated to the southwest on this belt, the Kempbell mine, near Canton, was partially worked with a mill of 5 stamps.

Near Villa Rica is the Colpton mine; it is stated that the mill is nearly ready.

About half a dozen men were employed in the petty work of Cherokee and Forsyth Counties, and the product was not less than $2,500. I was unable to learn of any petty work further southwest, though it is certain that all these counties, Bartow, Cobb, Paulding, Haralson, Carroll, in Georgia, and Cleburne, in Alabama, were small producers, to the extent, I should judge, of $5,000 to $10,000.

Near Buford, in Gwinnett County, is the Earl Percy mine, operated with 5 stamps. Very little work was done in 1883, though it is reported that the material was fairly abundant. There was also considerable petty work done in this and adjacent counties, as was evidenced by the frequency of small shipments from Buford and other points near by, reaching, it is believed, $1,000.

At the Price mine, in Hall County, half a mile west of Odel Station, some work was done, but was not persisted in, for the ores were so sulphureted as to be refractory.

At Gant's, in Forsyth County, some prospecting work was done, but it was not learned that anything of importance was likely to result. In Oglethorpe County very desultory work was undertaken.

The Magruder mine, in Lincoln County, was worked in the same manner as in 1882; it is not known as a producer of bullion, for its ores are galena, and will need smelting.

On mines in the counties to the north of the main gold belt only individual and petty work was undertaken.

The production of Georgia in 1883 was approximated as follows:

| | |
|---|---|
| Carroll, Cobb, Paulding, and adjacent counties | $10,000 |
| Dawson County | 5,000 |
| Forsyth and Cherokee Counties | 10,000 |
| Hall and Gwinnett Counties | 5,000 |
| Lumpkin County | 122,500 |
| Rabun and Habersham Counties | 5,000 |
| White County | 16,500 |
| Towns, Fannin, Gilmer, Pickens, Union, and adjacent counties, miscellaneous. | 15,000 |
| Total | 188,000 |

Of this amount, judging from the greater purity of Georgia gold, I presume $1,000 is due to silver contents. The known shipments from Gainesville, from which the greater part of the production is sent, was nearly $157,000; from other points the movement was about $12,000. None of these shipments, so far as ascertainable, embraced the bullion produced in Cherokee, Cobb, Carroll, Forsyth, Towns, Union, Paulding, and adjacent counties, and only in part from Habersham, Hall, Gwinnett, and Rabun, and a little from the minor shipping points.

| | |
|---|---|
| Known movements from Gainesville | $157,000 00 |
| Known movements from other points | 12,000 00 |
| Total known movements | 169,000 00 |
| Known production for counties above named, not included in shipments above stated | 10,000 00 |
| Total | 179,000 00 |

The shipments from Atlanta and minor express offices cannot have been less than from $10,000 to $20,000.

I have adopted Mr. Hanna's estimate and placed the production of Georgia for 1883 at—gold, $199,000; silver, $1,000; total, $200,000.

The following list exhibits, so far as I am informed, the reducing machinery of Georgia at the close of 1883:

| | No. of stamps. |
|---|---|
| Auraria mine, Lumpkin County | 15 |
| Bast mine, Lumpkin County | 20 |
| Barlow mine, Lumpkin County | 40 |
| Bell mine, Lumpkin County | 10 |
| Bradley mill, White County | 20 |
| Blake mill, White County | 20 |
| Columbia mine, Lumpkin County | 20 |
| Calhoun mine, Lumpkin County | 40 |
| Cleveland mine, Lumpkin County | 10 |
| Chestatee mine, Lumpkin County | 40 |
| Chicago and Georgia mine, Lumpkin County | 20 |
| Cincinnati Consolidated mine, Dawson County | 10 |
| Danae mine, Lumpkin County | 10 |
| Dahlonega Gold Mining Company, Lumpkin County | 10 |
| Dr. Charles's mine, Forsyth County (contracted for) | 20 |
| Earl Percy mine, Gwinnett County | 5 |
| Findley mine, Lumpkin County | 50 |
| Fish Trap mine, Lumpkin County | 20 |
| Franklin & McDonald mine, Cherokee County | 10 |
| Garnet mine, Lumpkin County | 20 |
| Hightower mine, Lumpkin County | 10 |
| Ivey mine, Lumpkin County | 60 |
| J. R. Dean's mine, White County | 5 |
| Kempbell mine, Cherokee County | 5 |
| Lexington mining Company, Oglethorpe County | 10 |
| Nacoochee Company's Mine, White County | 20 |
| Pigeon Roost mine, Lumpkin County | 10 |
| Ralston Branch mine, Lumpkin County | 20 |
| Singleton mine, Lumpkin County | 25 |
| Smith mine, Rabun County | 10 |
| Thompson mine, White County | 5 |
| Wells mine, Lumpkin County | 10 |
| Total | 600 |

It is probable that there may be other mills at work concerning which I have no knowledge, which may swell the list a little. Most of these stamps were actively at work during the year.

## ALABAMA.

In Alabama nothing of importance was done during the year. In Cleburne County, in the continuation of the Georgia belt, there was some desultory work, and the production was small. Considerable work is said to have been done in the vicinity of Dadeville, Tallapoosa County, in two localities, at one of which a 5-stamp mill was at work, and at the other a mill is likely to be erected soon.

The production of this State in 1883 may have reached $10,000, all in gold.

## VIRGINIA.

The following description of the copper and silver mines located in Loudoun County, Virginia, and operated by the Eagle Mining Company, has been furnished by Frank A. Wise, the general manager:

"The Loudoun County copper and silver mines, owned and operated by the Eagle Mining Company of Alexandria, Va., are located in the northeast corner of Loudoun County, Virginia, lying on the west bank of Goose Creek, 3 miles northeast of Leesburg and within 2 miles of the Washington, Ohio and Western Railroad. The tract of land has been known for many years as California, owing to discoveries of sulphuret ores containing both copper, gold, and silver, and some prospecting work was done in 1852. But the veins which are now being developed were discovered and opened up by the general manager of the Eagle Mining Company after the purchase of the property by its present owners. Ground was broken on the 6th day of February, 1883, and the work has proceeded uninterruptedly up to this date (December 31, 1883). Work commenced on a vein cropping out and running parallel with the mother vein, a few feet distant, and a shaft was sunk 30 feet deep. An open cut was then run on the main vein for a distance of about 30 feet to the southeast, and an incline about 30 feet to the northwest, and some 50 tons of carbonate of copper, carrying silver, was extracted from these two points, working on the vein to a depth of 25 feet, average depth of the whole from end to end being about 17 feet. The vein on the surface carried carbonate of copper, and as depth was obtained showed considerable red oxides and sulphides of copper, running 51 per cent. in copper and 27 ounces silver per ton. The course of the vein is northwest and southeast, with a slope to the southwest, having a well-defined smooth wall on the northeast side; the width of the vein matter from the wall, as far as worked, is from 3 to 8 feet, when it slopes off at an angle of about 45°. A shaft has been sunk at this point to a depth of 40 feet, and a drift running southwest is now in about 15 feet; the formation is a red rock, very much like porphyry and very heavy in spar, the spar increasing as the drift advances. Two spars or seams have been cut in running this drift, which contain most beautiful crystals of spar, showing rich stains of carbonates of copper. About 500 feet to the southwest from the above workings a shaft is being sunk, and is now down 34 feet on a vein of yellow sulphurets of copper, capped with iron ore; this shaft is in ore all the way down, and the vein has continued to increase as depth is attained. Considerable water has been met with, though easily handled without the aid of pumps. The mines have been visited by a great many persons during the past six months and much interest manifested in the developments. Several mining experts have given the veins a close examination and pronounced them of great promise."

# GENERAL STATISTICS.

[Wells, Fargo & Co., express and banking.]

SAN FRANCISCO, *January* 1, 1884.

DEAR SIR: The following is a copy of our annual statement of precious metals produced in the States and Territories west of the Missouri River (including British Columbia and receipts by express from the west coast of Mexico) during 1883, which shows aggregate products as follows: Gold, $29,236,492; silver, $47,229,649; copper, $5,683,921; lead, $8,163,550; total gross result, $90,313,612.

California shows a decrease in gold of $1,629,028, and an increase of silver of $969,844. Nevada shows a falling off of $1,591,755. The Comstock shows an increase of $392,468; but there is a decrease in the product of Eureka district of $1,419,124. With the exception of Montana and Idaho there is a decrease in the product of the other States and Territories.

The facilities afforded for the transportation of bullion, ores, and base metals, by the extension of railroads into the mining districts, increase the difficulty of verifying the reports of the products from several important localities; and the general tendency is to exaggeration when the actual values are not obtainable from authentic sources; but the aggregate result as shown herein we think may be relied on with reasonable confidence as approximately correct.

| States and Territories. | Gold dust and bullion by express. | Gold dust and bullion by other conveyances. | Silver bullion by express. | Ores and base bullion by freight. | Total. |
|---|---|---|---|---|---|
| California | $13, 182, 188 | $659, 109 | $1, 171, 748 | $660, 269 | $15, 673, 314 |
| Nevada | 1, 097, 595 | | 5, 924, 252 | 1, 749, 774 | 8, 771, 621 |
| Oregon | 387, 927 | 193, 963 | 11, 090 | | 592, 980 |
| Washington | 42, 117 | 21, 058 | 351 | | 63, 526 |
| Alaska | 85, 000 | 20, 000 | | | 105, 000 |
| Idaho | 1, 077, 985 | 215, 597 | 692, 545 | 1, 819, 700 | 3, 805, 827 |
| Montana | 2, 380, 000 | 119, 000 | 4, 900, 000 | 2, 480, 000 | 9, 879, 000 |
| Utah | 27. 036 | 4, 134 | 2, 398, 627 | 4, 587, 885 | 7, 017, 682 |
| Colorado | 2, 341, 692 | | 4, 434, 444 | 17, 533, 864 | 24, 310, 000 |
| New Mexico | 123, 642 | 50, 000 | 1, 190, 977 | 2, 048, 900 | 3, 413, 519 |
| Arizona | 340, 686 | 150. 000 | 4, 147, 427 | 3, 545, 630 | 8, 183, 743 |
| Dakota | 2, 448, 000 | 245, 000 | 130, 000 | | 2, 823, 000 |
| Mexico (west coast) | 767, 836 | | 3, 870, 548 | 384, 000 | 5, 022, 384 |
| British Columbia | 521, 613 | 130, 403 | | | 652, 016 |
| | 24, 823, 317 | 1, 808, 264 | 28, 872, 009 | 34, 810, 022 | 90, 313, 612 |

The gross yield for 1883, shown above, segregated, is approximately as follows:

| | Per cent. | Amount. |
|---|---|---|
| Gold | 32. 36 | $29, 236, 492 |
| Silver | 52. 30 | 47, 229, 649 |
| Copper | 6. 30 | 5, 683, 921 |
| Lead | 9. 04 | 8, 163, 550 |
| Description. | | 90, 313, 612 |

*Annual products of lead, copper, silver, and gold in the States and Territories west of the Missouri River*, 1870–'83.

| Year. | Products as per Wells, Fargo & Co.'s statements, including amounts from British Columbia and west coast of Mexico. | Product after deducting amounts from British Columbia and west coast of Mexico. | The net product of the States and Territories west of the Missouri River, exclusive of British Columbia and west coast of Mexico, divided, is as follows: | | | |
|---|---|---|---|---|---|---|
| | | | Lead. | Copper. | Silver. | Gold. |
| 1870 | $54, 000, 000 | $52, 150, 000 | $1, 080, 000 | ............ | $17, 320, 000 | $33, 750, 000 |
| 1871 | 58, 284, 000 | 55, 784, 000 | 2, 100, 000 | ............ | 19, 286, 000 | 34, 398, 000 |
| 1872 | 62, 236, 959 | 60, 351, 824 | 2, 250, 000 | ............ | 19, 924, 429 | 38, 177, 395 |
| 1873 | 72, 258, 693 | 70, 139, 860 | 3, 450, 000 | ............ | 27, 483, 302 | 39, 206, 558 |
| 1874 | 74, 401, 045 | 71, 965, 610 | 3, 800, 000 | ............ | 29, 699, 122 | 38, 466, 488 |
| 1875 | 80, 889, 057 | 76, 703, 433 | 5, 100, 000 | ............ | 31, 635, 239 | 39, 968, 194 |
| 1876 | 90, 875, 173 | 87, 219, 859 | 5, 040, 000 | ............ | 39, 292, 924 | 42, 886, 935 |
| 1877 | 98, 421, 754 | 95, 811, 582 | 5, 085, 250 | ............ | 45, 846, 109 | 44, 880, 223 |
| 1878 | 81, 154, 622 | 78, 276, 167 | 3, 452, 000 | ............ | 37, 248, 137 | 37, 576, 030 |
| 1879 | 75, 349, 501 | 72, 688, 888 | 4, 185, 769 | ............ | 37, 032, 857 | 31, 470, 262 |
| 1880 | 80, 167, 936 | 77, 232, 512 | 5, 742, 390 | $898, 000 | 38, 033, 055 | 32, 559, 067 |
| 1881 | 84, 504, 417 | 81, 198, 474 | 6, 361, 902 | 1, 195, 000 | 42, 987, 613 | 30, 653, 959 |
| 1882 | 92, 411, 835 | 89, 207, 549 | 8, 008, 155 | 4, 055, 037 | 48, 133, 039 | 29, 011, 318 |
| 1883 | 90, 313, 612 | 84, 639, 212 | 8, 163, 550 | 5, 683, 921 | 42, 975, 101 | 27, 816, 640 |

The exports of silver during the present year to Japan, China, India, the Straits, &c., have been as follows: From Southampton, $33,260,237; from Marseilles, $851,840; from San Francisco, $4,498,546; total, $38,610,623, as against $43,266,000 in 1882.

JNO. J. VALENTINE.
*Vice-President and General Superintendent.*

*Deposits and purchases of gold and silver bullion during the calendar year ended December* 31, 1883.

| Description. | Mints. | | | | | Assay offices. | | | | | Total. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Philadelphia. | San Francisco. | Carson. | Denver. | New Orleans. | New York. | Boisé. | Helena. | Charlotte. | Saint Louis. | |
| GOLD. | | | | | | | | | | | |
| United States bullion (domestic production) | $212, 166 12 | $18, 773, 265 92 | $1, 429, 845 02 | $1, 357, 691 41 | $9, 363 68 | $7, 166, 022 55 | $177, 990 14 | $764, 775 18 | $112, 772 54 | $9, 473 64 | $30, 013, 366 20 |
| United States coin | 176, 595 01 | 3, 706 70 | .......... | .......... | 12, 040 26 | 182, 451 59 | .......... | .......... | 17 30 | 694 14 | 375, 505 00 |
| Foreign bullion | 54, 504 67 | 1, 772, 130 40 | .......... | .......... | 15, 109 70 | 5, 363, 421 04 | .......... | .......... | .......... | 6 66 | 7, 205, 172 47 |
| Foreign coin | 20, 018 57 | 3, 629, 694 90 | .......... | .......... | 36, 614 69 | 7, 951, 985 40 | .......... | .......... | 58 01 | 4, 402 27 | 11, 642, 773 84 |
| Jewelers' bars, old plate, &c | 639, 236 99 | 19, 203 27 | .......... | 2, 619 55 | 29, 890 46 | 1, 135, 427 09 | .......... | 175 09 | 998 83 | 25, 087 38 | 1, 852, 638 66 |
| Total | 1, 102, 521 36 | 24, 198, 001 19 | 1, 429, 845 02 | 1, 360, 310 96 | 103, 018 79 | 21, 799, 307 67 | 177, 990 14 | 764, 950 27 | 113, 846 68 | 39, 664 09 | 51, 089, 456 17 |
| Redeposits: | | | | | | | | | | | |
| Fine bars | 1, 013 29 | .......... | .......... | 222 08 | .......... | 1, 293, 392 13 | .......... | .......... | .......... | .......... | 1, 294, 627 50 |
| Unparted bars | 1, 475, 098 72 | 157, 856 61 | .......... | 1, 576 56 | .......... | 403, 303 50 | 630 43 | .......... | .......... | .......... | 2, 038, 465 82 |
| Total gold received and operated upon | 2, 578, 633 37 | 24, 355, 857 80 | 1, 429, 845 02 | 1, 362, 109 60 | 103, 018 79 | 23, 496, 003 30 | 178, 620 57 | 764, 950 27 | 113, 846 68 | 39, 664 09 | 54, 422, 549 49 |
| SILVER. | | | | | | | | | | | |
| United States bullion (domestic production) | 12, 169, 488 96 | 5, 553, 843 11 | 1, 162, 456 03 | 17, 560 80 | 8, 059, 460 83 | 5, 444, 855 46 | 2, 206 10 | 28, 564 33 | 707 42 | 5, 041 63 | 32, 444, 184 67 |
| United States coin | 189, 213 00 | 3, 752 92 | 134 52 | .......... | 11, 088 45 | 1, 619 11 | .......... | .......... | 89 73 | 94 56 | 205, 992 29 |
| Foreign bullion | 1, 747 10 | 1, 902, 758 96 | .......... | .......... | 25, 476 07 | 366, 225 09 | .......... | .......... | .......... | 131 04 | 2, 296, 338 26 |
| Foreign coin | 481, 811 47 | 26, 025 72 | .......... | .......... | 1, 030, 505 81 | 114, 443 39 | .......... | .......... | 55 79 | .......... | 1, 652, 842 18 |
| Jewelers' bars, old plate, &c | 111, 778 52 | 4, 576 14 | .......... | .......... | 25, 316 20 | 234, 860 56 | .......... | 3 06 | 82 95 | 2, 209 68 | 378, 827 11 |
| Total | 12, 954, 039 05 | 7, 490, 956 85 | 1, 162, 590 55 | 17, 560 80 | 9, 151, 847 36 | 6, 162, 003 61 | 2, 206 10 | 28, 567 39 | 935 89 | 7, 476 91 | 36, 978, 184 51 |
| Redeposits: | | | | | | | | | | | |
| Fine bars | 822, 282 73 | 183, 822 97 | 17, 131 66 | .......... | .......... | 26, 360 16 | .......... | .......... | .......... | .......... | 1, 049, 597 52 |
| Unparted bars | 16, 928 00 | 35, 021 02 | .......... | .......... | .......... | 17, 772 89 | 13 47 | .......... | .......... | .......... | 69, 735 38 |
| Total silver received and operated upon | 13, 793, 249 78 | 7, 709, 800 84 | 1, 179, 722 21 | 17, 560 80 | 9, 151, 847 36 | 6, 206, 136 66 | 2, 219 57 | 28, 567 39 | 935 89 | 7, 476 91 | 38, 097, 517 41 |
| Gold and silver deposits and purchases | 14, 056, 560 41 | 31, 688, 958 04 | 2, 592, 435 57 | 1, 377, 871 76 | 9, 254, 866 15 | 27, 961, 311 28 | 180, 196 24 | 793, 517 66 | 114, 782 57 | 47, 141 00 | 88, 067, 640 68 |
| Redeposits: | | | | | | | | | | | |
| Gold | 1, 476, 112 01 | 157, 856 61 | .......... | 1, 798 64 | .......... | 1, 696, 695 63 | 630 43 | .......... | .......... | .......... | 3, 333, 093 32 |
| Silver | 839, 210 73 | 218, 843 99 | 17, 131 66 | .......... | .......... | 44, 133 05 | 13 47 | .......... | .......... | .......... | 1, 119, 332 90 |
| Total gold and silver received and operated upon | 16, 371, 883 15 | 32, 065, 658 64 | 2, 609, 567 23 | 1, 379, 670 40 | 9, 254, 866 15 | 29, 702, 139 96 | 180, 840 14 | 793, 517 66 | 114, 782 57 | 47, 141 00 | 92, 520, 066 90 |

*Deposits of gold of domestic production during the calendar year ended December* 31, 1883.

| Locality. | Mints. | | | | | Assay offices. | | | | | Total. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Philadelphia. | San Francisco. | Carson. | Denver. | New Orleans. | New York. | Boisé. | Helena. | Charlotte. | Saint Louis. | |
| Alabama | $26 77 | | | | | $120 65 | | | | | $147 42 |
| Alaska | | $56, 071 87 | | | | | | | | | 56, 071 87 |
| Arizona | 192 50 | 206, 726 78 | | | | 11, 778 10 | | | | | 218, 697 38 |
| California | 1, 131 09 | 6, 490, 767 09 | $107, 706 66 | | | 4, 886 96 | | | | $324 63 | 6, 604, 816 43 |
| Colorado | 4, 118 30 | | | $1, 357, 691 41 | | 1, 372, 614 25 | | | | 4, 112 95 | 2, 738, 536 91 |
| Dakota | 28, 042 79 | | | | | 3, 047, 868 43 | | | | | 3, 075, 911 22 |
| Georgia | 14, 591 18 | | | | | 64, 932 90 | | | $36, 877 04 | | 116, 401 12 |
| Idaho | 810 57 | 522, 124 71 | | | | 126, 161 03 | $135, 447 70 | | | 350 76 | 784, 894 77 |
| Maine | 121 34 | | | | | | | | | | 121 34 |
| Maryland | 310 25 | | | | | | | | | | 310 25 |
| Michigan | | | | | | 27 83 | | | | | 27 83 |
| Montana | 628 47 | 48, 566 08 | | | $9, 363 68 | 638, 454 46 | | $764, 775 18 | | 740 15 | 1, 462, 528 02 |
| Nevada | 36 97 | 427, 459 61 | 1, 322, 138 36 | | | 104, 465 36 | | | | 15 05 | 1, 854, 115 35 |
| New Mexico | 80, 049 43 | 681 06 | | | | 47, 893 85 | | | | 3, 930 10 | 132, 554 44 |
| North Carolina | 59, 159 28 | | | | | 8, 603 41 | | | 32, 531 15 | | 100, 293 84 |
| Oregon | | 419, 947 55 | | | | 1, 123 29 | 42, 542 44 | | | | 463, 613 28 |
| South Carolina | 5, 113 19 | | | | | | | | 43, 314 38 | | 48, 427 57 |
| Tennessee | 382 21 | | | | | 169 60 | | | | | 551 81 |
| Texas | | 97 86 | | | | | | | | | 97 86 |
| Utah | | 18, 245 80 | | | | 48, 650 29 | | | | | 66, 896 09 |
| Vermont | | | | | | 2, 811 70 | | | | | 2, 811 70 |
| Virginia | 3, 339 69 | | | | | 2, 953 47 | | | 49 97 | | 6, 343 13 |
| Washington Territory | | 25, 216 91 | | | | 115 30 | | | | | 25, 332 21 |
| Wyoming | 3, 968 22 | 287 67 | | | | | | | | | 4, 255 89 |
| Refined bullion | 245 49 | 10, 498, 189 17 | | | | 1, 682, 391 67 | | | | | 12, 180, 826 33 |
| Other sources | 9, 898 38 | 58, 883 76 | | | | | | | | | 68, 782 14 |
| Total gold | 212, 166 12 | 18, 773, 265 92 | 1, 429, 845 02 | 1, 357, 691 41 | 9, 363 68 | 7, 166, 022 55 | 177, 990 14 | 764, 775 18 | 112, 772 54 | 9, 473 64 | 30, 013, 366 20 |

*Deposits of silver of domestic production during the calendar year ended December 31, 1883.*

| Locality. | Mints. | | | | | Assay offices. | | | | | Total. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Philadelphia. | San Francisco. | Carson. | Denver. | New Orleans. | New York. | Boisé. | Helena. | Charlotte. | Saint Louis. | |
| Alabama | | | | | | $1 05 | | | | | $1 05 |
| Alaska | | $562 58 | | | | | | | | | 562 58 |
| Arizona | $0 70 | 1,006,025 57 | | | | 70,827 68 | | | | | 1,076,853 95 |
| California | 21 25 | 482,775 10 | $22,941 38 | | | 1,480 82 | | | | $4 01 | 507,222 56 |
| Colorado | 4,227 96 | | | $17,560 80 | | 256,827 70 | | | | 4,985 43 | 283,601 89 |
| Dakota | 209 74 | | | | | 114,516 18 | | | | | 114,725 92 |
| Georgia | 55 40 | | | | | 375 93 | | | $179 68 | | 611 01 |
| Idaho | 49,031 62 | 54,376 41 | | | | 69,594 18 | $1,681 43 | | | 1 55 | 174,685 19 |
| Maine | 64 | | | | | | | | | | 64 |
| Michigan | 10,642 41 | | | | | 15,850 42 | | | | | 26,492 83 |
| Montana | 21,465 39 | 142,356 08 | | | | 1,737,061 68 | | $28,564 33 | | 24 52 | 1,929,472 00 |
| Nevada | 139 92 | 2,787,441 95 | 1,139,514 65 | | | 40,988 74 | | | | 87 | 3,968,086 13 |
| New Mexico | 432,154 43 | 20 05 | | | | 287,269 62 | | | | 25 25 | 719,469 35 |
| North Carolina | 424 11 | | | | | 88 35 | | | 285 11 | | 797 57 |
| Oregon | | 4,566 46 | | | | 156 28 | 524 67 | | | | 5,247 41 |
| South Carolina | 119 46 | | | | | | | | 242 63 | | 362 09 |
| Tennessee | 1 94 | | | | | | | | | | 1 94 |
| Texas | | 394 94 | | | $2,005 57 | | | | | | 2,400 51 |
| Utah | | 293,801 32 | | | | 1,499,792 94 | | | | | 1,793,594 26 |
| Vermont | | | | | | 6 44 | | | | | 6 44 |
| Virginia | 15 55 | | | | | 24 21 | | | | | 39 76 |
| Washington Territory | | 340 75 | | | | 2 51 | | | | | 343 26 |
| Wyoming | 23 78 | 1 75 | | | | | | | | | 25 53 |
| Refined bullion | 11,649,506 94 | 328,359 98 | | | 8,057,455 26 | 1,349,990 73 | | | | | 21,385,312 91 |
| Other sources | 1,447 72 | 452,820 17 | | | | | | | | | 454,267 89 |
| Total silver | 12,169,488 96 | 5,553,843 11 | 1,162,456 03 | 17,560 80 | 8,059,460 83 | 5,444,855 46 | 2,206 10 | 28,564 33 | 707 42 | 5,041 63 | 32,444,184 67 |

*Gold and silver of domestic production deposited at the mints and assay offices from their organization to the close of the calendar year ended December* 31, 1883.

| Locality. | Gold. | Silver. | Total. |
|---|---|---|---|
| Alabama | $222, 877 32 | $7 20 | $222, 884 52 |
| Alaska | 144, 164 82 | 1, 095 39 | 144, 260 21 |
| Arizona | 3, 424, 972 71 | 13, 454, 177 32 | 16, 879, 150 03 |
| California | 729, 648, 862 50 | 3, 563, 077 85 | 733, 211, 940 35 |
| Colorado | 44, 697, 406 39 | 22, 670, 060 68 | 67, 367, 467 07 |
| Dakota | 20, 359, 755 11 | 274, 570 78 | 20, 634, 325 89 |
| Georgia | 8, 159, 651 63 | 2. 135 79 | 8, 161, 687 42 |
| Idaho | 26, 680, 568 84 | 1, 266, 627 95 | 27, 947, 196 79 |
| Indiana | 40 13 | | 40 13 |
| Maine | 5, 714 03 | 22 64 | 5, 736 67 |
| Maryland | 1, 910 40 | 59 | 1, 910 99 |
| Massachusetts | | 917 56 | 917 56 |
| Michigan | 167 54 | 3, 554, 832 55 | 3, 555, 000 09 |
| Montana | 54, 414, 824 36 | 9, 967, 388 19 | 64, 382, 212 55 |
| Nevada | 20, 377, 872 76 | 89, 625, 522 95 | 110, 003, 395 71 |
| New Hampshire | 11, 020 55 | | 11, 020 55 |
| New Mexico | 1, 915, 327 63 | 5, 351, 180 01 | 7, 266, 507 64 |
| North Carolina | 10, 484, 496 63 | 48, 142 77 | 10, 532, 639 40 |
| Oregon | 17, 856, 162 64 | 51, 638 46 | 17, 907, 801 10 |
| South Carolina | 1, 517, 281 67 | 819 85 | 1, 518, 101 52 |
| Tennessee | 87, 726 93 | 9 22 | 87, 736 15 |
| Texas | 97 86 | 2, 400 51 | 2, 498 37 |
| Utah | 672, 651 28 | 17, 461, 999 64 | 18, 134, 650 92 |
| Vermont | 13, 792 97 | 49 94 | 13, 842 91 |
| Virginia | 1, 714, 076 80 | 204 77 | 1, 714, 281 57 |
| Washington Territory | 310, 967 42 | 1, 024 63 | 311, 992 05 |
| Wyoming | 734, 151 46 | 11, 855 54 | 746, 007 00 |
| Refined bullion | 257, 895, 245 38 | 113, 480, 503 06 | 371, 375, 748 44 |
| Parted from silver | 16, 699, 768 48 | | 16, 699, 768 48 |
| Contained in silver | 9, 322, 268 97 | | 9, 322, 268 97 |
| Parted from gold | | 7, 073, 251 68 | 7, 073, 251 68 |
| Contained in gold | | 586, 284 79 | 586, 284 79 |
| Other sources | 10, 705, 037 82 | 33, 668, 135 40 | 44, 373, 173 22 |
| Total | 1, 238, 078, 863 03 | 322, 117, 937 71 | 1, 560, 196, 800 74 |

UNITED STATES ASSAY OFFICE, NEW YORK CITY,
SUPERINTENDENT'S OFFICE,
*March* 4, 1884.

SIR: In answer to your letter of the 18th ultimo, I forward herewith statements showing the approximate amounts of gold and silver bars, prepared at this office during the calendar year 1883, for manufacturers' use, similar to the statement on page 56 of the last Annual Report of the Director of the Mint, viz:

*Bars paid to depositors, used in the arts, &c., during the calendar year* 1883.

| Description. | Gold. | Silver. |
|---|---|---|
| United States coin | $1, 309 40 | $1, 361 11 |
| Foreign coin | 151, 756 74 | 80, 514 83 |
| Foreign bullion | 224, 392 00 | 306, 132 38 |
| Domestic bullion | 3, 617, 533 40 | 4, 575, 769 01 |
| Jewelers' bars, plate, &c | 706, 828 17 | 179, 879 16 |
| Redeposits (New York assay-office bars) | 1, 278, 586 06 | 22, 572 03 |
| Total | 5, 980, 405 77 | 5, 166, 228 52 |

Very respectfully,

ANDREW MASON,
*Superintendent.*

HON. H. C. BURCHARD,
*Director of the Mint, Washington, D. C.*

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*Imports of gold and silver bullion at San Francisco during calendar year* 1883.

| Source. | Silver bullion. | Silver coin. | Gold bullion. | Gold coin. | Total. |
|---|---|---|---|---|---|
| British Australasia | | | $1, 413, 111 | $2, 333, 444 | $3, 746, 55 |
| British Columbia | | $390 | 542, 012 | 31, 780 | 574, 182 |
| Central American states | | 21, 158 | | 12, 959 | 34, 117 |
| China | | 2, 590 | | 189, 436 | 192, 026 |
| French Possessions | | 60, 467 | | 6, 008 | 66, 475 |
| Hawaiian Islands | | 7, 523 | | 4, 118 | 11, 641 |
| Japan | | 6, 660 | | 899, 275 | 905, 935 |
| Mexico | $1, 943, 362 | 2, 193, 499 | 15, 153 | 55, 141 | 4, 207, 155 |
| Total | 1, 943, 362 | 2, 292, 287 | 1, 970, 276 | 3, 532, 161 | 9, 738, 086 |

*Exports of gold and silver bullion from San Francisco during calendar year* 1883.

| Source. | Domestic silver bullion. | Domestic gold bullion. | Domestic silver coin. | Foreign silver coin. | Domestic gold coin. | Foreign gold coin. | Hawaiian silver coin. | Total. |
|---|---|---|---|---|---|---|---|---|
| British Possessions in Australasia | | | | | | $6, 200 | | $6, 200 |
| Central American states | | | $19, 000 | $1, 700 | $14, 120 | | | 34, 820 |
| China | $220, 702 | | | 88, 000 | | | | 308, 702 |
| Hawaiian Islands | | | 15, 598 | 750 | 10, 000 | 29, 480 | $300, 000 | 355, 828 |
| Hong Kong | 4, 461, 141 | $28, 385 | | 3, 893, 681 | 565, 472 | | | 8, 948, 679 |
| Japan | 694, 732 | | | 166, 000 | | | | 860, 732 |
| Mexico | | | | | 1, 100 | | | 1, 100 |
| United States of Colombia | | | | | 1, 000 | | | 1, 000 |
| All other islands and ports | | | | 24, 308 | | | | 24, 308 |
| Total | 5, 376, 575 | 28, 385 | 34, 598 | 4, 174, 439 | 591, 692 | 35, 680 | 300, 000 | 10, 541, 369 |

*Production of gold and silver from the mines of the State of Nevada during the calendar year ended December* 31, 1883, *compared with calendar year* 1882.

| Name of mine. | 1882. | | | 1883. | | |
|---|---|---|---|---|---|---|
| | Quantity of ore worked. | | Value per ton. | Quantity of ore worked. | | Value per ton. |
| | Tons. | Value. | | Tons. | Value. | |
| CHURCHILL COUNTY. | | | | | | |
| Churchill Mill and Mining Company | | | | 289 | $1, 451 99 | |
| Total yield | | | | 289 | 1, 451 99 | |
| ELKO COUNTY. | | | | | | |
| Argenta | | | | 185 | 15, 022 00 | $81 20 |
| Central Consolidated | 60 | $3, 805 26 | $63 42 | | | |
| De Frees Mine | 114 | 552 43 | 4 84 | | | |
| De Frees Mill | 5 | 85 66 | 17 13 | | | |
| Edward Reily | | | | 700 | 25, 200 00 | 36 00 |
| Grand Prize | | | | 646 | 55, 815 96 | 86 40 |
| Independence | 202 | 48, 035 82 | 237 80 | 2, 693 | 430, 457 80 | 159 84 |
| Navajo | 1, 968 | 272, 400 36 | 138 41 | | | |
| Total ores | 2, 349 | 324, 879 53 | | 4, 224 | 526, 495 76 | |
| Tailings worked | 1, 850 | 8, 904 93 | | | | |
| Total yield | 4, 199 | 333, 784 46 | | 4, 224 | 526, 495 76 | |
| ESMERALDA COUNTY. | | | | | | |
| Cortez | | | | 696 | 12, 930 37 | 18 57 |
| Great Western | 37 | 5, 819 80 | 157 29 | 615 | 80, 961 49 | 131 64 |
| Indian Queen | 1, 835 | 104, 721 79 | 57 07 | | | |
| Lancashire | 79 | 11, 683 97 | 147 89 | 278 | 36, 021 19 | 129 57 |
| Mount Diablo | 3, 072 | 118, 979 38 | 38 73 | 8, 726 | 471, 102 93 | 53 98 |
| Northern Belle | 20, 798 | 765, 815 84 | 36 82 | 9, 806 | 297, 142 95 | 30 30 |
| Wilson | 120 | 4, 100 84 | 34 17 | | | |
| Total yield | 25, 941 | 1, 011, 121 62 | | 20, 121 | 898, 158 93 | |
| EUREKA COUNTY. | | | | | | |
| Albion | 2, 807 | 106, 902 03 | 38 08 | 3, 710 | 125, 258 00 | 33 76 |
| Alexandria | 10 | 324 29 | 32 43 | 113 | 5, 896 50 | 52 18 |
| Altoona | 1 | 198 63 | 198 63 | 8 | 2, 521 65 | 315 20 |
| Antelope | 2 | 145 39 | 72 69 | 2 | 141 27 | 70 63 |
| Atlantic and Pacific | 19 | 421 44 | 22 18 | | | |
| Alturas | | | | 1 | 32 38 | 32 38 |
| Austin | | | | 8 | 1, 549 28 | 193 66 |
| Berin | | | | 1 | 29 07 | 29 07 |
| Berryman | | | | 1 | 69 20 | 69 20 |
| Bald Eagle | 55 | 3, 124 30 | 56 80 | 73 | 4, 985 23 | 68 29 |
| Banner | 135 | 6, 110 31 | 45 26 | 88 | 4, 310 29 | 48 98 |
| Benton | 18 | 357 09 | 19 83 | | | |
| Bertrand M. and M. Company | 8, 193 | 124, 251 62 | 15 17 | 17, 449 | 214, 928 70 | 12 31 |
| Black Point | 3 | 330 85 | 110 28 | | | |
| Bowman | 263 | 19, 300 86 | 73 38 | 72 | 3, 262 47 | 45 31 |
| Bullwhacker | 122 | 3, 922 01 | 32 14 | | | |
| Billi Anzelli | | | | 2 | 70 36 | 35 18 |
| Brown | | | | 7 | 191 49 | 27 35 |
| Butler | | | | 7 | 217 91 | 31 13 |
| Contention | 9 | 1, 000 00 | 111 11 | | | |
| Christie | | | | 3, 186 | 33, 793 68 | 10 60 |
| Connell | | | | 1 | 50 31 | 50 31 |
| Connelly | | | | 3 | 80 77 | 26 92 |
| Cameron | | | | 1 | 95 34 | 95 34 |
| Cardinal | | | | 4 | 403 37 | 100 84 |
| Casey | | | | 1 | 18 90 | 18 90 |
| Cortez | | | | 2 | 149 09 | 74 54 |
| Crossan | | | | 6 | 150 00 | 25 00 |
| Charles Heyer | | | | 61 | 1, 386 94 | 22 73 |
| Dead Broke | 42 | 2, 409 43 | 57 36 | 37 | 2, 065 22 | 55 81 |
| Dug Out | 148 | 11, 739 03 | 79 32 | 111 | 8, 881 24 | 80 01 |
| Dunderberg | 1, 120 | 41, 343 53 | 36 91 | | | |
| Delaware | | | | 15 | 422 40 | 28 16 |
| El Dorado No. 2 | 49 | 2, 946 86 | 60 14 | 29 | 1, 467 17 | 50 59 |
| Eureka Consolidated | 22, 357 | 990, 012 67 | 44 28 | 9, 512 | 205, 564 45 | 21 61 |
| Eureka Tunnel and M. Company | 1, 205 | 74, 790 70 | 62 06 | 1, 529 | 74, 055 48 | 48 43 |
| Excelsior | 130 | 3, 819 22 | 29 38 | 10 | 166 10 | 16 61 |
| Extension | 1 | 62 74 | 62 74 | | | |
| Enterprise, Prospect Mountain | | | | 6 | 184 88 | 30 81 |
| Enterprise | | | | 584 | 8, 375 02 | 14 34 |

*Production of gold and silver from the mines of the State of Nevada*—Continued.

| Name of mine. | 1882. | | | 1883. | | |
|---|---|---|---|---|---|---|
| | Quantity of ore worked. | | Value per ton. | Quantity of ore worked. | | Value per ton. |
| | Tons. | Value. | | Tons. | Value. | |
| EUREKA COUNTY—Continued. | | | | | | |
| Este | | | | 2 | $229 78 | $114 89 |
| Eastern | | | | 1 | 51 32 | 51 32 |
| Eureka Star | | | | 4 | 122 87 | 30 72 |
| Evans | | | | 1 | 40 84 | 40 84 |
| Franky Scott | | | | 1 | 24 40 | 24 40 |
| Five Twenty | | | | 2 | 148 77 | 74 38 |
| Fandi | | | | 25 | 1, 051 18 | 42 04 |
| Fourth of July | | | | 6 | 332 29 | 55 38 |
| Fletcher | | | | 3 | 171 35 | 57 12 |
| Garrison | 981 | $42, 671 25 | $43 50 | 860 | 55, 398 70 | 64 41 |
| Gilham | 7 | 490 95 | 70 13 | | | |
| Grant | | | | 46 | 2, 352 62 | 51 14 |
| Gilmore | | | | 1 | 40 28 | 40 28 |
| Hamburg | 18 | 544 24 | 30 23 | 471 | 18, 245 45 | 38 73 |
| Herculean | 7 | 136 70 | 19 53 | 216 | 3, 552 27 | 16 45 |
| Home Ticket | 57 | 1, 502 51 | 26 36 | | | |
| Hoosa | 51 | 1, 460 76 | 28 64 | | | |
| Hunter | 3 | 359 31 | 119 77 | | | |
| Horace Toney | | | | 5 | 115 65 | 23 13 |
| Hartnett | | | | 3 | 127 34 | 42 45 |
| Idaho | 324 | 11, 211 95 | 34 60 | 157 | 5, 784 14 | 36 84 |
| Industry | 3 | 90 82 | 30 27 | 5 | 244 55 | 48 91 |
| Irish Ambassador | 13 | 2, 468 84 | 189 91 | 30 | 4, 923 73 | 164 12 |
| Ione | | | | 1 | 44 18 | 44 18 |
| Jackson | 631 | 30, 039 02 | 47 60 | 1, 399 | 48, 861 29 | 34 92 |
| Kentuck | 9 | 1, 215 38 | 135 04 | 12 | 1, 087 55 | 90 63 |
| K. K. Furnace | | | | 60 | 1, 043 77 | 17 40 |
| Lizzie L | 4 | 156 58 | 39 14 | | | |
| Lone Pine | 3 | 54 11 | 18 03 | | | |
| Lawson | | | | 1 | 11 08 | 11 08 |
| Little Mac | | | | 1 | 25 37 | 25 37 |
| Macon City | 154 | 5, 230 56 | 33 96 | 9 | 592 42 | 65 82 |
| Mayflower | 17 | 256 54 | 15 09 | | | |
| Members | 216 | 4, 592 54 | 21 26 | 273 | 3, 608 92 | 13 22 |
| Metamoras | 106 | 4, 767 78 | 44 98 | 17 | 405 59 | 23 85 |
| Molino and Frazer | 8 | 134 57 | 16 82 | | | |
| Mountain Boy | 28 | 3, 269 55 | 116 77 | 4 | 551 20 | 137 80 |
| May Day | | | | 1 | 108 41 | 108 41 |
| Magnet | | | | 4 | 124 68 | 31 17 |
| Margueritte | | | | 9 | 618 42 | 68 71 |
| Medlin | | | | 1 | 21 69 | 21 69 |
| Mineral Hill | | | | 1 | 170 64 | 170 64 |
| Mountaineer | | | | 3 | 111 76 | 37 25 |
| McBride | | | | 16 | 439 33 | 27 45 |
| McCuen | | | | 23 | 497 15 | 21 61 |
| McDonald | | | | 5 | 86 27 | 17 25 |
| McManni | | | | 1 | 31 90 | 31 90 |
| North Macon City | 14 | 1, 569 05 | 112 07 | | | |
| Onondago | 31 | 2, 378 81 | 76 73 | 356 | 15, 900 38 | 44 66 |
| Oneida and Belmont | 63 | 1, 530 95 | 24 30 | 28 | 637 95 | 22 78 |
| Ozark | | | | 4 | 70 54 | 17 63 |
| Orange | | | | 2 | 28 62 | 14 31 |
| Paul Pry | 110 | 4, 866 59 | 44 24 | 2 | 3, 261 79 | 1, 630 89 |
| Phœnix | 333 | 12, 581 48 | 37 78 | 201 | 6, 359 29 | 31 63 |
| Prospect Mountain Tunnel | 55 | 1, 394 62 | 25 36 | 5 | 274 19 | 54 84 |
| Piuto | | | | 1 | 64 28 | 64 28 |
| Pentier | | | | 3 | 109 64 | 36 54 |
| Purcell | | | | 1 | 40 02 | 40 02 |
| Republic | 20 | 402 10 | 20 10 | 42 | 765 24 | 18 22 |
| Richmond Consolidated | 30, 446 | 873, 610 55 | 28 69 | 7, 783 | 154, 477 00 | 19 85 |
| Richmond of Nevada | | | | 10, 488 | 286, 273 11 | 27 29 |
| Ruby and Dunderberg | 555 | 10, 963 73 | 19 75 | 3, 667 | 92, 860 14 | 25 32 |
| Ross | | | | 6 | 171 92 | 28 65 |
| Rose | | | | 1 | 57 13 | 57 13 |
| Ryland | | | | 1 | | |
| San José | 16 | 1, 020 57 | 63 78 | 9 | 405 74 | 45 08 |
| Seventy-Six | 63 | 4, 645 79 | 73 74 | | | |
| Silver Connor | 148 | 89, 894 18 | 607 39 | 242 | 8, 799 83 | 36 36 |
| Silver King | 34 | 524 45 | 15 42 | | | |
| Silver Lick | 266 | 11, 321 18 | 42 56 | 100 | 6, 272 22 | 62 72 |
| Silver West | 2 | 108 14 | 54 07 | 4 | 142 43 | 35 61 |
| Star | 1 | 118 72 | 118 72 | | | |
| Silver Reef | | | | 5 | 1, 357 49 | 271 49 |

*Production of gold and silver from the mines of the State of Nevada, &c.*—Continued.

| Name of mine. | 1882. | | | 1883. | | |
|---|---|---|---|---|---|---|
| | Quantity of ore worked. | | Value per ton. | Quantity of ore worked. | | Value per ton. |
| | Tons. | Value. | | Tons. | Value. | |
| EUREKA COUNTY—Continued. | | | | | | |
| Snow Cloud | | | | 1 | $21 71 | $21 71 |
| Silver Stone | | | | 4 | 117 70 | 29 42 |
| Sunset | | | | 4 | 145 47 | 36 36 |
| Vegas | | | | 6 | 305 07 | 50 84 |
| War Eagle | 10 | $251 47 | $25 15 | | | |
| Wide West | 11 | 172 80 | 15 71 | | | |
| Williams | 63 | 3,071 15 | 48 75 | 71 | 4,772 76 | 67 22 |
| Williamsburg | 270 | 8,713 09 | 32 27 | | | |
| Woodchopper | | | | 9 | 1,371 34 | 152 37 |
| Wren | | | | 1 | 34 36 | 34 36 |
| Total | 71,840 | 2,453,306 38 | | 63,307 | 1,436,728 75 | |
| Tailings worked | | | | 6,668 | 178,565 64 | |
| Total yield | 71,840 | 2,453,306 38 | | 69,975 | 1,615,294 39 | |
| HUMBOLDT COUNTY. | | | | | | |
| Auburn Consolidated | 600 | 1,500 00 | 2 50 | | | |
| Bullion of Paradise | 3,231 | 38,373 14 | 11 87 | | | |
| Winnemucca Reduction Works | 111 | 2,724 00 | 24 54 | | | |
| Total yield | 3,942 | 42,597 14 | | | | |
| LANDER COUNTY. | | | | | | |
| Betty O'Neal | 824 | 79,430 17 | 96 39 | | | |
| Black Ledge | 6 | 3,496 71 | 582 78 | | | |
| Breen | | | | 8 | 2,341 94 | 292 74 |
| Great Eastern | | | | 22 | 3,818 13 | 173 55 |
| Holman & Co | 11 | 4,534 03 | 412 18 | | | |
| Lady of the Lake | | | | 87 | 8,386 79 | 96 40 |
| Lander & Paxton | | | | 985 | 158,126 20 | 160 53 |
| London | | | | 26 | 3,032 92 | 116 65 |
| Manhattan Silver Mining Company | 1,854 | 377,645 58 | 203 69 | 1,972 | 480,924 87 | 243 88 |
| Mullens | 4 | 6,388 57 | 1,597 14 | | | |
| Merced | | | | 16 | 5,862 18 | 366 38 |
| New Battle Mountain | 501 | 39,679 58 | 79 20 | 376 | 25,306 70 | 67 30 |
| Patriot | 85 | 31,197 45 | 367 03 | 139 | 40,070 15 | 288 27 |
| Plymouth | 26 | 16,472 21 | 633 54 | 22 | 8,490 16 | 385 91 |
| Renfree & Co | 35 | 6,901 58 | 197 18 | | | |
| Silver Wedge | 1 | 3,494 44 | 3,494 44 | 309 | 84,164 49 | 272 37 |
| Silver Side | | | | 38 | 6,872 66 | 180 86 |
| San Francisco Tunnel | | | | 19 | 3,053 95 | 160 73 |
| Tribute | | | | 102 | 35,231 71 | 345 40 |
| Victoria | 809 | 6,724 16 | 8 31 | | | |
| Total yield | 4,156 | 575,964 48 | | 4,121 | 865,682 85 | |
| LINCOLN COUNTY. | | | | | | |
| Alps | 2 | 350 90 | 175 45 | 5 | 419 75 | 83 95 |
| Bristol Silver Mining Company | 1,058 | 55,261 36 | 52 23 | | | |
| Bullionville Smelting Company | 17,137 | 97,572 93 | 5 69 | 18,251 | 85,460 32 | 4 68 |
| Bald Balk | | | | 1 | 110 90 | 110 90 |
| Bluett | | | | 4 | 298 90 | 74 72 |
| Day Silver Mining Company | 4,076 | 122,074 58 | 29 95 | | | |
| Dry Valley concentrations | 35 | 1,208 57 | 34 53 | | | |
| Fairview | | | | 2 | 191 25 | 95 62 |
| Garrison | | | | 2 | 265 25 | 132 62 |
| John Purcher | | | | 3 | 378 00 | 126 00 |
| J. Powers | | | | 3 | 146 52 | 48 84 |
| Lazard Frères | 10 | 1,039 74 | 103 97 | | | |
| Lucky Jim | 7 | 873 56 | 124 79 | | | |
| L. J. Mine | | | | 100 | 3,500 00 | 35 00 |
| Los Angeles | | | | 3 | 452 81 | 150 94 |
| Mountain Boy | 3 | 177 15 | 59 05 | | | |
| May Flower | | | | 7 | 294 00 | 42 00 |
| Meadow Valley | | | | 52 | 1,955 00 | 37 59 |
| Morning Star | | | | 12 | 2,419 00 | 201 58 |
| Southwestern Mining Company | 1,794 | 70,560 34 | 39 33 | 765 | 24,770 00 | 32 37 |

*Production of gold and silver from the mines of the State of Nevada, &c.*—Continued.

| Name of mine. | 1882. | | | 1883. | | |
|---|---|---|---|---|---|---|
| | Quantity of ore worked. | | Value per ton. | Quantity of ore worked. | | Value. per ton. |
| | Tons. | Value. | | Tons. | Value. | |
| LINCOLN COUNTY—Continued. | | | | | | |
| Techattieuk | | | | 618 | $23, 815 95 | $38 53 |
| Vermillion | 4 | $403 65 | $100 91 | | | |
| Washington and Creole | | | | 3 | 120 00 | 40 00 |
| Total | 24, 126 | 349, 522 78 | | 19, 831 | 144, 597 65 | |
| Tailings worked | 14, 261 | 108, 283 78 | | 17, 209 | 109, 803 47 | |
| Total yield | 38, 387 | 457, 806 56 | | 37, 040 | 254, 401 12 | |
| LYON COUNTY. | | | | | | |
| Atlanta Mill | 9, 340 | 28, 801 61 | 3 08 | | | |
| C. C. Stevenson | | | | 302 | 6, 057 23 | 20 05 |
| Excelsior Mill | 1, 620 | 6, 934 35 | 4 28 | | | |
| Franklin Mill | 810 | 1, 885 07 | 2 32 | | | |
| J. M. Douglas & Co. Mill | 17, 215 | 45, 848 69 | 2 66 | | | |
| Little Bonanza Mill | 1, 480 | 12, 540 00 | 8 47 | | | |
| Lyon Milling and Mining Co | 20, 308 | 86, 200 88 | 4 24 | | | |
| Lower Comstock Mining Co | | | | 60 | 1, 200 00 | 20 00 |
| Total | 50, 773 | 182, 210 60 | | 902 | 7, 257 23 | |
| Tailings worked | | | | 58, 466 | 165, 091 33 | |
| Total | 50, 773 | 182, 210 60 | | 69, 368 | 172, 348 56 | |
| NYE COUNTY. | | | | | | |
| Blue Bell | 9 | 1, 359 22 | 151 02 | 108 | 9, 834 12 | 91 05 |
| Belmont | | | | 1, 542 | 42, 254 38 | 27 40 |
| Continental | 117 | 12, 692 18 | 108 48 | | | |
| Downieville | 539 | 24, 845 20 | 46 09 | 422 | 21, 177 18 | 50 18 |
| Downieville Smelting Works | 378 | 17, 812 80 | 47 12 | | | |
| F. E. Osgood | | | | 3 | 359 99 | 119 99 |
| Gold Park | 70 | 3, 954 37 | 56 49 | | | |
| Grey Eagle | 3 | 213 77 | 71 25 | | | |
| Good Hope | | | | 1 | 170 00 | 170 00 |
| Harrison Brothers | 1, 900 | 13, 200 00 | 6 95 | | | |
| Jefferson | | | | 560 | 15, 477 00 | 27 63 |
| La Salle | | | | 1 | 162 81 | 162 81 |
| McPherson | 2 | 505 14 | 252 57 | | | |
| Morey | 298 | 32, 997 43 | 110 73 | | | |
| Nevada Mining Company | 1, 353 | 12, 787 93 | 9 45 | | | |
| N. F. Leon | | | | 12 | 963 41 | 80 28 |
| Prussian | | | | 390 | 5, 207 00 | 13 35 |
| Queen Elizabeth | 5 | 1, 085 74 | 217 14 | 4 | 1, 114 41 | 278 60 |
| Reveille | | | | 12 | 1, 582 24 | 131 85 |
| Silver Point | | | | 187 | 8, 510 00 | 45 50 |
| Tybo Consolidated | 3, 768 | 89, 902 07 | 23 85 | 1, 700 | 60, 525 00 | 35 60 |
| Twin River | 300 | 4, 860 77 | 16 20 | 1, 800 | 22, 785 09 | 12 65 |
| Unknown Mine | | | | 538 | 11, 100 00 | 20 63 |
| Total yield | 8, 742 | 216, 216 62 | | 7, 280 | 201, 222 63 | |
| ORMSBY COUNTY. | | | | | | |
| Brunswick Mill | 1, 506 | 6, 975 13 | 4 63 | | | |
| Total yield. | 1, 506 | 6, 975 13 | | | | |
| STOREY COUNTY. | | | | | | |
| Andes | | | | 123 | 1, 722 00 | 14 00 |
| Belcher | 18, 398 | 303, 095 91 | 16 47 | 12, 230 | 219, 902 24 | 17 98 |
| California | 611 | 10, 122 86 | 16 56 | | | |
| Challenge | 414 | 5, 703 18 | 13 77 | 1, 059 | 14, 026 88 | 13 24 |
| Chollar Potosi | 1, 440 | 24, 166 03 | 16 78 | 22, 058 | 292, 708 32 | 13 26 |
| Confidence | 572 | 8, 211 28 | 14 35 | 217 | 3, 038 78 | 14 00 |
| Consolidated Imperial | 2, 697 | 37, 328 37 | 13 84 | 554 | 7, 794 75 | 14 07 |
| Crown Point | 40, 196 | 442, 967 05 | 11 02 | 40, 544 | 483, 622 75 | 11 92 |
| Kentuck | 5, 939 | 156, 052 22 | 26 27 | 11, 094 | 257, 327 05 | 23 19 |
| Lady Bryan | | | | 1, 680 | 9, 760 00 | 5 81 |
| Monte Christo | | | | 1, 250 | 15, 427 13 | 12 34 |
| Ophir | 3, 667 | 74, 230 51 | 20 24 | 4, 728 | 45, 040 40 | 9 52 |

*Production of gold and silver from the mines of the State of Nevada, &c.*—Continued.

| Name of mine. | 1882. | | | 1883. | | |
|---|---|---|---|---|---|---|
| | Quantity of ore worked. | | Value per ton. | Quantity of ore worked. | | Value per ton. |
| | Tons. | Value. | | Tons. | Value. | |
| STOREY COUNTY—Continued. | | | | | | |
| Savage | | | | 118 | $1,358 00 | $11 50 |
| T. Huley | | | | 325 | 1,868 70 | 5 75 |
| Union Consolidated | 10,744 | $318,291 12 | $29 62 | 1,163 | 20,821 41 | 17 90 |
| W. Rodda | | | | 300 | 2,700 00 | 9 00 |
| W. Roe & Co | | | | 150 | 1,050 00 | 7 00 |
| Yellow Jacket | 5,493 | 88,044 78 | 16 02 | 29,556 | 445,105 43 | 15 06 |
| Total | 90,171 | 1,468,213 31 | | 127,149 | 1,823,273 84 | |
| Tailings worked | 24,440 | 106,883 66 | | 1,653 | 5,920 98 | |
| Total yield | 114,611 | 1,575,096 97 | | 128,802 | 1,829,194 82 | |
| WHITE PINE COUNTY. | | | | | | |
| Bay State | 154 | 11,583 41 | 75 21 | 1,935 | 39,247 48 | 20 28 |
| Blue Bell | | | | 186 | 2,728 00 | 14 66 |
| Chloride | 25 | 2,193 13 | 87 72 | | | |
| El Capitan | 150 | 2,500 00 | 16 67 | | | |
| Exchange | 282 | 6,486 00 | 23 00 | | | |
| Exchequer | | | | 114 | 1,968 00 | 17 26 |
| Fort Hayne and Credit | | | | 854 | 1,708 00 | 2 00 |
| Fair Play | | | | 510 | 35,401 23 | 69 41 |
| Gore | 483 | 23,014 10 | 47 64 | | | |
| Monitor | 1,625 | 71,393 40 | 43 93 | 1,875 | 66,187 50 | 35 30 |
| Mountain Queen | 30 | 922 55 | 30 73 | | | |
| Paymaster | | | | 2,112 | 109,091 05 | 51 65 |
| Rescue | | | | 44 | 4,920 00 | 111 82 |
| Star | 3,053 | 139,594 70 | 45 72 | 798 | 34,335 83 | 43 02 |
| Stafford | | | | 800 | 10,897 60 | 13 62 |
| Total | 5,802 | 257,687 29 | | 9,228 | 306,484 69 | |
| Tailings worked | 800 | 8,000 00 | | 6,133 | 14,838 65 | |
| Total yield | 6,602 | 265,687 29 | | 15,361 | 321,323 34 | |

*Estimate made by A. M. Lawver of the bullion production of Arizona for the calendar year* 1883.

| County. | Gold. | Silver (coining value). | Total. |
|---|---|---|---|
| Cochise | $385,000 | $3,615,000 | $4,000,000 |
| Gila | 25,000 | 375,000 | 400,000 |
| Graham | 20,000 | 150,000 | 170,000 |
| Maricopa | 350,000 | 400,000 | 750,000 |
| Mohave | 20,000 | 200,000 | 220,000 |
| Pima | 85,000 | 500,000 | 585,000 |
| Pinal | 20,000 | 1,050,000 | 1,070,000 |
| Yavapai | 25,000 | 1,035,000 | 1,060,000 |
| Yuma | 30,000 | 150,000 | 180,000 |
| Total | 960,000 | 7,475,000 | 8,435,000 |

*tatement showing the value and character of the gold and silver used in the arts and manufactures during the calendar year 1883, as reported by the persons and firms who had been addressed.*

GOLD.

| Manufactures. | Number manufacturing. | United States coin. | Stamped United States or refinery bars. | Old jewelry, plate, and other old material. | Foreign coin. | Native grains, nuggets, &c. | Wire or rolled plate. | Total gold. |
|---|---|---|---|---|---|---|---|---|
| Watch-cases | 32 | $575, 812 | $2, 976, 550 | $38, 101 | $1, 508 | $520 | $5, 817 | $3, 598, 308 |
| Watch-chains | 14 | 374, 997 | 286, 884 | 1, 907 | 600 | 135, 410 | 27, 202 | 827, 000 |
| Dental supplies | 7 | 700 | 33, 437 | 3, 775 | ........ | ........ | ........ | 37, 912 |
| Pens | 14 | 14, 578 | 90, 325 | 6, 100 | 5, 227 | 2, 134 | 27, 560 | 145, 924 |
| Instruments | 45 | 68 | .......... | 3, 568 | ....... | 621 | 942 | 5, 199 |
| Leaf | 51 | 178, 424 | 792, 551 | 57, 498 | 6, 816 | 6, 700 | 42, 835 | 1, 084, 824 |
| Plate | 219 | 379, 291 | 67, 928 | 5, 500 | 590 | 8, 933 | 66, 626 | 528, 868 |
| Spectacles | 41 | 192, 400 | 7, 169 | 8, 830 | 1, 315 | 4, 987 | 727 | 215, 428 |
| Chemicals | 27 | 7, 438 | 7, 685 | 3, 551 | 550 | 207 | 12, 180 | 31, 611 |
| Jewelry and watchmakers' supplies | 11 | 24, 498 | 13, 983 | 9, 123 | ........ | 1, 569 | 30, 054 | 79, 227 |
| Jewelry and watches | 2, 273 | 3, 125, 738 | 2, 861, 149 | 738, 688 | 177, 794 | 541, 306 | 458, 745 | 7, 905, 163 |
| Total | 2, 734 | 4, 875, 587 | 7, 137, 661 | 876, 641 | 194, 400 | 702, 387 | 672, 688 | 14, 459, 464 |

SILVER.

| Manufactures. | United States coin. | Stamped United States or refinery bars. | Old jewelry, plate, and other old material. | Foreign coin. | Native grains, nuggets, &c. | Wire or rolled plate. | Total silver. | Total silver and gold. |
|---|---|---|---|---|---|---|---|---|
| Watch-cases | $35, 200 | $1, 777, 193 | $31, 937 | $219 | $1, 000 | $50 | $1 845, 599 | $5, 443, 907 |
| Watch-chains | 524 | 14, 768 | ........ | ........ | 6, 790 | 1, 462 | 23, 544 | 850, 544 |
| Dental supplies | 450 | 6, 060 | ........ | ........ | ........ | 228 | 6, 738 | 44, 650 |
| Pens | 216 | 4, 254 | 100 | 1, 655 | 505 | ........ | 6, 730 | 152, 654 |
| Instruments | 931 | 3, 752 | 693 | 755 | 864 | 6, 995 | 13, 990 | 19, 189 |
| Leaf | 11 | 22, 697 | 4, 107 | 300 | 835 | 18, 933 | 46, 883 | 1, 131, 707 |
| Plate | 16, 856 | 1, 710, 515 | 40, 761 | 7, 690 | 8, 495 | 281, 977 | 2, 066, 294 | 2, 595, 162 |
| Spectacles | 3, 631 | 16, 461 | 1, 254 | 205 | 250 | 1, 981 | 23, 782 | 239, 210 |
| Chemicals | 9 | 375, 429 | 35, 554 | 500 | 1, 580 | 3, 347 | 416, 419 | 448, 030 |
| Jewelry and watchmakers' supplies | 245 | 4, 806 | 800 | ........ | 1, 505 | 975 | 8, 331 | 87, 558 |
| Jewelry and watches | 158, 564 | 616, 237 | 106, 745 | 142, 949 | 49, 733 | 23, 992 | 1, 098, 220 | 9, 003, 383 |
| Total | 216, 637 | 4, 552, 172 | 221, 951 | 154, 273 | 71, 557 | 339, 940 | 5, 556, 530 | 20, 015, 994 |

*Character and value of the precious metals reported by manufacturers, jewelers, and others, used by them during the calendar year 1883.*

| Character. | Gold. | Silver. | Total. |
|---|---|---|---|
| United States coin | $4, 875, 587 | $216, 637 | $5, 092, 224 |
| Stamped United States or refinery bars | 7, 137, 761 | 4, 552, 172 | 11, 689, 933 |
| Old jewelry, plate, and other old material | 876, 641 | 221, 951 | 1, 098, 592 |
| Foreign coin | 194, 400 | 154, 273 | 348, 673 |
| Native grains, nuggets, &c | 702, 387 | 71, 557 | 773, 944 |
| Wire or rolled plate | 672, 688 | 339, 940 | 1, 012, 628 |
| Value | 14, 459, 464 | 5, 556, 530 | 20, 015, 994 |

| | |
|---|---|
| NOTE.—The figures on page 15 have been increased in gold | $236, 016 |
| And in silver | 163, 753 |
| A total of | 399, 769 |

By later returns.

## *List of the mines of the United States producing gold and silver.*

[Compiled by E. O. Leech.]

### ALASKA.

| Name of mine. | District. | County. |
|---|---|---|
| Bullion | Silver Bow |  |
| Lucky Chance | Sitka |  |
| North Star | Silver Bow |  |
| Paris | Douglas Island |  |
| Placers | Cassia |  |
| Do | Douglas Island |  |
| Do | Goat Creek |  |
| Do | McGinnis |  |
| Do | Montana |  |
| Placers | Silver Bow |  |
| Do | Stikeen |  |
| Do | Sun Dum |  |
| Silver Bow Basin. | Juneau |  |
| Stewart Tunnel | Sitka |  |
| Takon Union | Juneau |  |
| Webster | Silver Bow |  |
| Witch | Sitka |  |

### ARIZONA.

| Name of mine. | District. | County. |
|---|---|---|
| Abbie Waterman. | Silver Hill | Pima. |
| Albany | Tucson | Do. |
| Alberta | Silver | Yuma. |
| Alice | Mineral Hill | Pinal. |
| Alpha | Hualapai | Mohave. |
| Alps | Tombstone | Cochise. |
| Alta | Greaterville | Pima. |
| Amelia | Silver Hill | Do. |
| American Flag | Walker | Yavapai. |
| Do | Maynard | Mohave. |
| Antelopo | do | Do. |
| Aravapa | Wilcox | Cochise. |
| Argus | Tip Top | Yavapai. |
| Arizona | Aubrey | Mohave. |
| Arizona Central | Myers | Maricopa. |
| Arizona Peerless | do | Do. |
| Arizonite | Walker | Yavapai. |
| Arkansas | Arivaca | Pima. |
| Atlanta | Benson | Cochise. |
| Aubrey | Aubrey | Mohave. |
| Aunt Sallie | Tombstone | Cochise. |
| Baltimore | Tucson | Pima. |
| Bear | Teriston | Cochise. |
| Bella | do | Do. |
| Belle | Big Bug | Yavapai. |
| Do | Walker | Do. |
| Belmont | Washington | Pima. |
| Ben Butler | Harshaw | Do. |
| Berkshire | Teviston | Cochise. |
| Big Comet | Tombstone | Do. |
| Big Horn | Ash Peak | Graham. |
| Black Copper | Gold Gulch | Do. |
| Black Rock | Silver | Yavapai. |
| Black and Tan | Cerbat | Mohave. |
| Black Warrior | Peck | Yavapai. |
| Blue Bell | Stockton | Mohave. |
| Do | Cave Creek | Maricopa. |
| Blue Bird | Belle Air | Pinal. |
| Blue Dick | Hassayampa | Yavapai. |
| Blue Jacket | Tombstone | Cochise. |
| Blue Jay | Washington | Pima. |
| Blue Monday | Tombstone | Cochise. |
| Blue Top | do | Do. |
| Bob Ingersoll | do | Do. |
| Bonanza | do | Do. |
| Do | Ash Peak | Graham. |
| Boston | Tucson | Pima. |
| Bruiser | Box Canyon | Pinal. |
| Buckeye | Tiger | Yavapai. |
| Do | Cave Creek | Maricopa. |
| Buena Vista | Amole | Pima. |
| Buffalo | Globe | Gila. |
| Bule | Big Bug | Yavapai. |
| Bulk Head | Ash Peak | Graham. |
| Bullion | Wrightson | Pima. |
| Do | Big Bug | Yavapai. |
| Do | Oro Blanco | Pima. |
| Do | Turkey Creek | Yavapai. |
| Bulleyview | Chloride | Mohave. |
| Bumble Bee | Teviston | Cochise. |
| Bunker Hill | Box Canyon | Pinal. |
| Do | Tombstone | Cochise. |
| Burro | Owens | Mohave. |
| Burro Burro | Myers | Maricopa. |
| By Chance | Owl's Head | Pinal. |
| Cactus | Tombstone | Cochise. |
| Caledonia | Castle Dome | Yuma. |
| Camp Cole | Tip Top | Yavapai. |
| Carbonate Chief | Magazine | Maricopa. |
| Cash Entry | Turkey Creek | Yavapai. |
| Catharine | Magazine | Maricopa. |
| Cerbat | Cerbat | Mohave. |
| Chambord | Globe | Gila. |
| Champion | Cerbat | Mohave. |
| Charlotte | Stockton | Do. |
| Chico | Magazine | Maricopa. |
| Chicago | Teviston | Cochise. |
| Do | Groom Creek | Yavapai. |
| Chief | Owl's Head | Pinal. |
| Chloride | Pioneer | Do. |
| Chloride King | Rogers | Do. |
| Christmas Gift | Casa Grande | Do. |
| Cincinnati | Stockton | Mohave. |
| Clara Dean | Tombstone | Cochise. |
| Cleopatra | Arivaca | Pima. |
| Clifton Hydraulic | Clifton | Graham. |
| Clip | Silver | Yuma. |
| C. O. D | Tombstone | Cochise. |
| Columbia | Belle Air | Pinal. |
| Concord | Pioneer | Do. |
| Confidence | Oro Blanco | Pima. |
| Congress | Mineral Creek | Pinal. |
| Connor | Chloride | Mohave. |
| Copper Glance | Gold Gulch | Graham. |
| Copper Mountain | Big Bug | Yavapai. |
| Copperosity | Casa Grande | Pinal. |
| Contact | Tombstone | Cochise. |
| Contention | do | Do. |
| Crosscut | Tip Top | Yavapai. |
| Cupel | Stockton | Mohave. |
| Daisy | Tombstone | Cochise. |
| Davis | Washington | Pima. |
| Do | Hassayampa | Yavapai. |
| Dean | Maynard | Mohave. |
| Dean Richmond | Tombstone | Cochise. |
| Defense | Tombstone | Cochise. |
| Defiance | Turquois | Do. |
| Desert | Cababi | Pima. |
| Do | Owl's Head | Pinal. |
| Dickens | Rogers | Do. |
| Dividend | Aubrey | Mohave. |
| Domingo | Greaterville | Pima. |
| Donahue | Chloride | Mohave. |
| Dosoris | Hassayampa | Yavapai. |
| Dutch Girl | Teviston | Cochise. |
| Dwarf | Tombstone | Do. |
| East Side | do | Do. |
| Eden Lass | do | Do. |
| Eighty-one | Teviston | Do. |
| El Dorado | Tip Top | Yavapai. |
| Elder | Mineral Creek | Pinal. |
| Emerald | Tombstone | Cochise. |
| Emerald Copper | Quijotoa | Pima. |
| Emma | Oro Blanco | Do. |

*List of the mines of the United States producing gold and silver*—Continued.

ARIZONA—Continued.

| Name of mine. | District. | County. |
|---|---|---|
| Empire | Tombstone | Cochise. |
| Do | Chloride | Mohave. |
| Esperanze | Tiger | Yavapai. |
| Esmeralda | Hassayampa | Do. |
| Eucalyptus | Tombstone | Cochise. |
| Eugene | Aubrey | Mohave. |
| Eureka | Pioneer | Pinal. |
| Do | Black Hills | Yavapai. |
| Evening Star | Peck | Do. |
| Excursion | Tonto Basin | Do. |
| Fairfield | Hualapai | Mohave. |
| First Chance | Caluzas | Cochise. |
| First Prize | Cababi | Pima. |
| Flora Temple | Castle Dome | Yuma. |
| Flores | Cerbat | Mohave. |
| Flux | Washington | Pima. |
| Do | Benson | Cochise. |
| Foote | Globe | Gila. |
| Fortunate | Tombstone | Cochise. |
| Forty-nine | Empire | Pima. |
| Fountain | Teviston | Cochise. |
| Fountain Head | Stockton | Mohave. |
| Fontenoy | Cerbat | Do. |
| Foy | Tip Top | Yavapai. |
| Frankfort | Pioneer | Pinal |
| Franklin | Turkey Creek | Yavapai. |
| Franco American | Oro Blanco | Pima. |
| Gap | Mineral Creek | Pinal. |
| Garcia | Myers | Maricopa. |
| General Hancock | Greaterville | Pima. |
| General Meade | Teviston | Cochise. |
| Gentile Belle | Tombstone | Do. |
| Giant | Teviston | Do. |
| Gila Monster | Winnifred | Maricopa. |
| Gilded Age | Tombstone | Cochise. |
| Gipsy | Globe | Gila. |
| Girard | Tombstone | Cochise. |
| Gloretta | Greaterville | Pima. |
| Golconda Extension. | Todd's Basin | Mohave. |
| Gold Block | Walker | Yavapai. |
| Gold Note | Turkey Creek | Do. |
| Golden Fleece | Cave Creek | Maricopa. |
| Golden Gate | Globe | Gila. |
| Golden Rule | Cochise | Cochise. |
| Do | Pioneer | Pinal. |
| Golden Star | Aubrey | Mohave. |
| Do | Magazine | Maricopa. |
| Golden Wonder | Globe | Do. |
| Goodwin | Turkey Creek | Yavapai. |
| Goodenough | Tombstone | Cochise. |
| Gotham | Pioneer | Pinal. |
| Grand Central | Tombstone | Cochise. |
| Grand Dipper | do | Do. |
| Grand Prize | Cababi | Pima. |
| Grass Hopper | Washington | Mohave. |
| Great American | Gold Gulch | Graham. |
| GreatExpectation | do | Do. |
| Green Cloud | Tombstone | Cochise. |
| Green Monster | Cabezas | Do. |
| Greenwood | Aubrey | Mohave. |
| Gringoire | Wrightson | Pima. |
| Ground Hog | Tombstone | Cochise. |
| Gun Sight | Myers | Maricopa. |
| Hackberry | Maynard | Mohave. |
| Hamilton | Big Bug | Yavapai. |
| Hannibal | Ash Peak | Graham. |
| Happy Jack | Myers | Maricopa. |
| Do | Walker | Yavapai. |
| Harmonica | Gold Basin | Mohave. |
| Harenvar | Castle Dome | Yuma. |
| Hayes and Buck | Globe | Gila. |
| Helvetia | Tombstone | Cochise. |
| Hendricks | Warren | Do. |
| Hidden Treasure | Turquois | Do. |
| Holland | Washington | Pima. |
| Holmes | Turkey Creek | Yavapai. |
| Home Again | Harshaw | Pima. |
| Horn Silver | Aubrey | Mohave. |
| Howard | Mineral Creek | Gila. |
| Howell | Tombstone | Cochise. |
| Hunter's Rest | Magazine | Maricopa. |
| Infallible | Stockton | Mohave. |
| Inka | Arivaca | Pima. |
| Irene | Globe | Gila. |
| Ironclad | Walker | Yavapai. |
| Isabella | Cabezas | Cochise. |
| Do | Globe | Gila. |
| Ithaca | Hualapai | Mohave. |
| Ithaca Consolidated. | Cave Creek | Maricopa. |
| I. X. L | Stockton | Mohave. |
| Jack Rabbit | Casa Grande | Pinal. |
| Jackson | Tombstone | Cochise. |
| John Mackey | Empire | Pima. |
| Johnny Crapeau | Rogers | Pinal. |
| Joliet | Magazine | Maricopa. |
| Josie | Teviston | Cochise. |
| Josephine | Mineral Hill | Pinal. |
| Juniper | Cabezas | Cochise. |
| Keston | Mineral Creek | Pinal. |
| Keystone | Hualapai | Mohave. |
| Kimball | Walker | Yavapai. |
| Kittie | do | Do. |
| La Grande | Tombstone | Cochise. |
| Last Chance | Turquois | Do. |
| Lelo | Mineral Hill | Pinal. |
| Lena | Turquois | Cochise. |
| Lima | Tombstone | Do. |
| Lion | Magazine | Maricopa. |
| Little Field | Cababi | Pima. |
| Little Watson | Aumole | Do. |
| Little Wonder | Tombstone | Cochise. |
| Lone Star | Hualapai | Mohave. |
| Long Will | Owl's Head | Pinal. |
| Lost Prize | Mineral Hill | Do. |
| Low Divide | Gold Gulch | Graham. |
| Luck Sure | Tombstone | Cochise. |
| Luckahoe | Chloride | Mohave. |
| Lucky Cuss | Tombstone | Cochise. |
| Mac Morris | Globe | Gila. |
| Maggie May | Magazine | Maricopa. |
| Mamie | Tombstone | Cochise. |
| Mammoth | Silver Mountain | Yavapai. |
| Do | Tombstone | Cochise. |
| Do | Total Wreck | Pima. |
| Manhattan | Rogers | Pinal. |
| Maple Grove | Cabezas | Cochise. |
| Marcus | Weaver | Yavapai. |
| Maricopa | Magazine | Maricopa. |
| Mark | Globe | Gila. |
| Mary | Teviston | Cochise. |
| Mason | Tombstone | Do. |
| McCracken | Owens | Mohave. |
| McShackerty | Cave Creek | Maricopa. |
| Memphis | Walker | Yavapai. |
| Menton | Arivaca | Pima. |
| Middleton | Walker | Yavapai. |
| Mifflin | do | Do. |
| Mineral Peak | Teviston | Cochise. |
| Miner's Hope | Stockton | Mohave. |
| Minititlan | Tombstone | Cochise. |
| Mississippi | Maynard | Mohave. |
| Mohawk | Tucson | Pima. |
| Monarch | Rogers | Pinal. |
| Monarch of the Sea. | Pioneer | Do. |
| Montana | Oro Blanco | Pima. |
| Montreal | Greaterville | Do. |
| Moss | Maynard | Mohave. |
| Mount Ben Nevis | Quijotoa | Pima. |
| Mountain Maid | Tombstone | Cochise. |
| Mountain View | Pioneer | Pinal. |
| Mowry | Washington | Pima. |
| Mozambique | Tombstone | Cochise. |
| Nellie James | Turquois | Do. |
| Nellie Kenyon | Silver | Yuma. |
| New London | Todd's Basin | Mohave. |

*List of the mines of the United States producing gold and silver*—Continued.

ARIZONA—Continued.

| Name of mine. | District. | County. |
|---|---|---|
| Nero's Letter | Mineral Hill | Pinal. |
| Nil Desperandum | Oro Blanco | Pima. |
| North Point | Tombstone | Cochise. |
| Oakland | ...do | Do. |
| Occident | Peck | Yavapai. |
| Ohio | Pioneer | Pinal. |
| Old Guard | Tombstone | Cochise. |
| Old Jennie | Ontario | Mohave. |
| Old Man | Teviston | Cochise. |
| Old Stiff | Oro Blanco | Pima. |
| Old Woman | Teviston | Cochise. |
| Olie | Gold Gulch | Graham. |
| Olympic | Globe | Gila. |
| Omaha | Groom Creek | Yavapai. |
| Omega | Helvetia | Pima. |
| One Hundred and Ten. | Groom Creek | Yavapai. |
| Oro Plata | Todd's Basin | Mohave. |
| Owl's Last Whoop | Tombstone | Cochise. |
| Owl's Nest | ...do | Do. |
| Panther | Magazine | Maricopa. |
| Papago Chief | Quijotoa | Pima. |
| Peabody | Cochise | Cochise. |
| Pearl | Tip Top | Yavapai. |
| Peacock | Walker | Do. |
| Peck | Peck | Do. |
| Pedro | Tombstone | Cochise. |
| Peer | Quijotoa | Pima. |
| Peerless | ...do | Do. |
| Do | Turkey Creek | Yavapai. |
| Phœnix | Cave Creek | Cochise. |
| Pichaco | Cababi | Pima. |
| Pine Metal | Stockton | Mohave. |
| Pine Spring | Walker | Yavapai. |
| Pioneer | Pioneer | Pinal. |
| Do | Globe | Gila. |
| Plomosa | Tucson | Pima. |
| Pocahontas | Castle Dome | Yuma. |
| Poland | Big Bug | Yavapai. |
| Pride of the West | Ash Peak | Graham. |
| Prompter | Tombstone | Cochise. |
| Quien Sabe | Cave Creek | Maricopa. |
| Quick Relief | Hualapai | Mohave. |
| Do | Turkey Creek | Yavapai. |
| Rackensack | Magazine | Maricopa. |
| Railroad | Castle Dome | Yuma. |
| Rain Bow | Todd's Basin | Mohave. |
| Randolph | Tombstone | Cochise. |
| Rather | Chloride | Mohave. |
| Rattlesnake | Tombstone | Cochise. |
| Rea | Box Canyon | Pinal. |
| Real Del Norte | Walker | Yavapai. |
| Red Cloud | Silver | Do. |
| Red Dog | Winnifred | Maricopa. |
| Red Jacket | Teviston | Cochise. |
| Red Rover | Globe | Gila. |
| Do | Magazine | Maricopa. |
| Reward | Casa Grande | Pinal. |
| Right Bower | Cave Creek | Maricopa. |
| Robin | Rogers | Pinal. |
| Rodenburg & Co. | Tip Top | Yavapai. |
| Rogers | Chloride | Mohave. |
| Rupert | Wrightson | Pima. |
| San Antonio | Chloride | Mohave. |
| Do | Washington | Pima. |
| San Diego | Winnifred | Maricopa. |
| San José | Oro Blanco | Pima. |
| San Pedro | Tombstone | Cochise. |
| Santa Rosa | Pioneer | Pinal. |
| Saragossa | Greaterville | Pima. |
| Scarlet | Winnifred | Maricopa. |
| Schuylkill | Benson | Cochise. |
| Do | Chloride | Mohave. |
| Scott | Harshaw | Pima. |
| Sea Surge | Tombstone | Cochise. |
| Setting Sun | Mineral Park | Mohave. |
| Seventy-Eight | Cerbat | Do. |
| Seventy-Six | Tip Top | Yavapai. |
| Shamrock | Greaterville | Pima. |
| Sidney | Tombstone | Cochise. |
| Shelton | Walker | Yavapai. |
| Shot Copper | Ash Peak | Graham. |
| Silver Bell | Pioneer | Pinal. |
| Silver Belle | Belle Air | Do. |
| Silver Belt | Tombstone | Cochise. |
| Do | Big Bug | Yavapai. |
| Silver Cave | Cabezas | Cochise. |
| Do | Wrightson | Pima. |
| Silver Chief | Rogers | Pinal. |
| Silver Crown | Greaterville | Pima. |
| Silver Fame | Globe | Gila. |
| Silver King | Pioneer | Pinal. |
| Silver Monster | Stockton | Mohave. |
| Silver Museum | Tip Top | Yavapai. |
| Silver Nugget | Globe | Gila. |
| Silver Prince | Peck | Yavapai. |
| Silver Thread | Tombstone | Cochise. |
| Silverado | Pioneer | Pinal. |
| Smile of Fortune | Arivaca | Pima. |
| Snapp | Rogers | Pinal. |
| Snow Clad | Hassayampa | Yavapai. |
| South Oro Belle | Bradshaw | Do. |
| South Pioneer | Mineral Creek | Gila. |
| South Silver King | Pioneer | Pinal. |
| Speciepaying | Mineral Hill | Do. |
| Spondoolicks | Casa Grande | Do. |
| St. Elmo | Tombstone | Cochise. |
| Star | Mineral Creek | Pinal. |
| Starking | Cabezas | Cochise. |
| State of Maine | Tombstone | Do. |
| Stonewall | ...do | Do. |
| Do | Globe | Gila. |
| Summer | Hassayampa | Yavapai. |
| Surprise | Pioneer | Pinal. |
| Surrey | Tombstone | Cochise. |
| Syndicate | Turkey Creek | Yavapai. |
| Terrible | Gold Gulch | Graham. |
| Three Brothers | Tombstone | Cochise. |
| Tiger | Tiger | Yavapai. |
| Tip Top | Tip Top | Do. |
| Tombstone | Tombstone | Cochise. |
| Topea | Globe | Gila. |
| Total Wreck | Empire | Pima. |
| Toughnut | Tombstone | Cochise. |
| Tribute | ...do | Do. |
| True Blue | ...do | Do. |
| Truman King | Pioneer | Pinal. |
| Tuscumbia | Turkey Creek | Yavapai. |
| Union | Arivaca | Pima. |
| Vecol | Pioneer | Pinal. |
| Vekol | Casa Grande | Do. |
| Virginia No. 2 | Tip Top | Yavapai. |
| Vizina | Tombstone | Cochise. |
| Wade Hampton | Black Hills | Yavapai. |
| Wadleigh | Walker | Do. |
| Watoree | Oro Blanco | Pima. |
| Way Up | Tombstone | Cochise. |
| Weaver | Ontario | Mohave. |
| Westside | Tombstone | Cochise. |
| Do | Cave Creek | Maricopa. |
| White Chief | Teviston | Cochise. |
| William Penn | Castle Dome | Yuma. |
| Winfield | Tombstone | Cochise. |
| World Beater | Rogers | Pinal. |
| Woronoco | Tombstone | Cochise. |
| Yankee Boy | Pioneer | Pinal. |
| Do | Turkey Creek | Yavapai. |
| Yuba | Greaterville | Pima. |
| Zulu | Tonto Basin | Yavapai. |

*List of the mines of the United States producing gold and silver*—Continued.

## CALIFORNIA.

| Name of mine. | District. | County. |
|---|---|---|
| A. Peterson | Big Bar. | Trinity. |
| Abbey | Fine Gold Gulch | Fresno. |
| Adams | Smithsport | Placer. |
| After Thought | Round Mountain | Shasta. |
| A. J. Sturtevant | Junction City | Trinity. |
| Alabama | Whiskey Hill | Tuolumne. |
| Do | Glencoe | Calaveras. |
| Do | Modoc | Inyo. |
| Alaska | Pike City | Sierra. |
| Do | Slate Range | Yuba. |
| Albert Bros | Brownsville | Do. |
| Alderson | Placerville | El Dorado. |
| Alexander | Resting Springs | Inyo. |
| Do | Rich Gulch | Calaveras. |
| Alhambra | Calico | San Benardino. |
| Do | Greenwood | El Dorado. |
| Allen Bros | Oro Fino | Siskiyou. |
| Ally | Ivanpah | San Benardino. |
| Almatah | Auburn | Placer. |
| Alpha | Washington | Nevada. |
| Alta | Copperopolis. | Calaveras. |
| Amador and Sacramento. | Michigan Bar | Sacramento. |
| Amador Queen | Jackson | Amador, |
| Amelia | Poorman | San Diego. |
| American Hill | Clipper Flat | Sierra. |
| Ames | Gertrude | Fresno. |
| A. P. Hawkins | Trinity Center | Trinity. |
| Arata | Sierra City | Sierra. |
| Arcadian | Greenville | Plumas. |
| Arctic | Kearsarge | Inyo. |
| Argus Range | Sherman | Do. |
| Arish | Independence | Do. |
| Armand | Big Flat | Del Norte. |
| Armstrong and Hawkins. | Central Hill | Calaveras. |
| Armstrong and Roberts. | Rich Gulch | El Dorado. |
| Arnold | Columbia | Tuolumne. |
| Arnott | Brandy City | Sierra. |
| Arnott & Co | State Range | Yuba. |
| Aubrey | Cottage Grove | Del Norte. |
| Avalo | Cerro Gordo | Inyo. |
| A. W. Smith | Reading Creek | Trinity. |
| Backbone | Lewiston | Do. |
| Bailey Brown | Fort Jones | Siskiyou. |
| Baker Divide | Bath | Placer. |
| Bald Mountain | Forest City | Sierra. |
| Bald Mountain | do | Do. |
| Baltimore Drift | Forest Hill | Placer. |
| Banderitta | Bull Creek | Mariposa. |
| Banner | Morris Ravine | Butte. |
| Do | Glencoe | Calaveras. |
| Do | Blind Springs | Mono. |
| Do | Grass Valley | Nevada. |
| Barry & Co | Sawyer's Bar | Siskiyou. |
| Bartlett | Jackson | Amador. |
| Bebee Bar | Klamath River | Siskiyou. |
| Belle McGilroy | Calico | San Benardino. |
| Belleview | Auburn | Placer. |
| Belmont | do | Do. |
| Do | Cerro Gordo | Inyo. |
| Benfeldt | Smith's Flat | El Dorado. |
| Bennet & Miller | Forks of Salmon | Siskiyou. |
| Beveridge | Beveridge | Inyo. |
| Big Bar | Orleans Bar | Humboldt. |
| Big Blue | Kernville | Kern. |
| Big Central | Bully Chopp | Shasta. |
| Big Flat Gravel | Big Flat | Del Norte. |
| Big Gun | Michigan Bluff | Placer. |
| Big Spring | Forest Hill | Do. |
| Bird's Eye Creek | You Bet | Nevada. |
| Bismarck | West Point | Calaveras. |
| Do | Lewiston | Trinity. |
| Do | Calico | San Benardino. |
| Black | Rough & Ready. | Nevada. |
| Black Bear | Sawyer's Bar | Siskiyou. |
| Do | Black Bear | Do. |
| Do | Lewiston | Trinity. |
| Blackboard | Beveridge | Inyo. |
| Blackfoot | Calico | San Benardino. |
| Blair Mine | Smith's Flat | El Dorado. |
| Blass & McClusy | Trinity Center | Trinity. |
| Blazing Star | West Point | Calaveras. |
| Bliss & Co | Slate Range | Yuba. |
| Blue Bell | Wild Rose | Inyo. |
| Blue Gravel | Settler Creek | Amador. |
| Bodie | Bodie | Mono. |
| Bodie Tunnel | do | Do. |
| Bodie & Wallace | San Andreas | Calaveras. |
| Bolt's Hill | Lewiston | Trinty. |
| Bonanza | Tunnell Ridge | Calaveras. |
| Do | Sawyer's Bar | Siskiyou. |
| Bonanza Hydraulic. | Howland Flat | Sierra. |
| Bonanza King | Providence | San Bernardino. |
| Borago Broncho | Beveridge | Inyo. |
| Boston | Mokolumne Hill | Calaveras. |
| Do | Lewiston | Trinity. |
| Bowie & Co | Douglas City | Do. |
| Bowles | Rattlesnake Bar | Placer. |
| Brandy City | Camptonville | Yuba. |
| Do | Brandy City | Sierra. |
| Brean | Sherlock | Mariposa. |
| Britain | Beveridge | Inyo. |
| Brown Bear | Lewiston | Trinity. |
| Brown Monster | Independence | Inyo. |
| Bruce & Wheeler | Bath | Placer. |
| Brush Creek | Mountain House | Sierra. |
| Buckeye | Alleghany | Do. |
| Do | Douglas | Trinity. |
| Do | Tunnel Ridge | Calaveras. |
| Buchanan | Cherokee | Tuolumne. |
| Buckhorn | Murphy's | Calaveras. |
| Buena Vista | Cerro Gordo | Inyo. |
| Do | Sherlock's | Mariposa. |
| Bullard | Railroad Flat | Calaveras. |
| Bully Chopp | Bully Chopp | Shasta. |
| Bulwer | Bodie | Mono. |
| Bunker Hill | Happy Camp | Del Norte. |
| Burtling & Co | Volcano | Amador. |
| Butterfly | French Gulch | Fresno. |
| C. Dannenbrink | Cañon City | Trinity. |
| Calaveras | Murphy | Calaveras. |
| Calaveras W. and M. | Sand Hill | Do. |
| California | Table Rock | Sierra. |
| Campbell & Co | Etna | Siskiyou. |
| Campo Domico | Hornitos | Mariposa. |
| Camp & Co | Happy Camp | Del Norte. |
| Canada Hill | Canada Hill | Nevada. |
| Carroll Bros | Oro Fino | Siskiyou. |
| Carter Bar | Grass Valley | Trinity. |
| Castro | New Coso | Inyo. |
| Cedar Springs | Prospect Flat | El Dorado. |
| Centennial | Hamburg Bar | Siskiyou. |
| Chamberlin | Lewiston | Trinity. |
| Chapman | Railroad Flat | Calaveras. |
| Do | Greenwood | El Dorado. |
| Chapperal | Julian | San Diego. |
| Charlotte | Glencoe | Calaveras. |
| Chicago | South Fork | Shasta. |
| Do | Railroad Flat | Calaveras. |
| China Creek | Happy Camp | Del Norte. |
| China | Cottonwood | Siskiyou. |
| Christmas Gift | New Coso | Inyo. |
| Chung Kee | Mokolumne | Calaveras. |
| Churchill | French Gulch | Shasta. |
| Clarmont | Clarmont Hill | Plumas. |
| Clark and Woodbury. | Railroad Flat | Calaveras. |
| Classic Hill | Happy Camp | Del Norte. |
| Clear Creek | do | Do. |
| Cleveland | Scales Diggins | Sierra. |

*List of the mines of the United States producing gold and silver*—Continued.

CALIFORNIA—Continued.

| Name of mine. | District. | County. |
|---|---|---|
| C. M. Mead | Minersville | Trinity. |
| Coal Burner | Swansea | Inyo. |
| Coffin and Read | Placerville | El Dorado. |
| Collier | Murphy's | Calaveras. |
| Cold Springs | Grass Valley | Nevada. |
| Columbo | Sierra City | Sierra. |
| Compromise | Bull Creek | Mariposa. |
| Concentration | Old Woman's Gulch. | Calaveras. |
| Confidence | Angels | Do. |
| Do | Jackson | Amador. |
| Do | Modoc | Inyo. |
| Consolidated Wyoming. | Nevada | Nevada. |
| Consolidated Amador. | Sutter Creek | Amador. |
| Copper Grand | New Coso | Inyo. |
| Copper Prince | do | Do. |
| Cox & Co | Howland | Sierra. |
| Coyle and Freethy. | Trinity Creek | Trinity. |
| Cranage | Smith's Point | Placer. |
| Crescent | Greenville | Plumas. |
| Crater Hill | Auburn | Placer. |
| Craycroft | Downieville | Sierra. |
| Cronin | Lewiston | Trinity. |
| Crystal | Mendon | El Dorado. |
| Cuffee | Cuffee Creek | Trinity. |
| Cumberland | Bully Chopp | Shasta. |
| Cunningham Bros. | La Porte | Plumas. |
| D. Richards | Fur Cap | Sierra. |
| Dam | Damascus | Placer. |
| Dardanelles | Forest Hill | Do. |
| Day Moore | Junction City | Trinity. |
| David Uftan | Michigan Bar | Sacramento. |
| Day | Grisley Flat | El Dorado. |
| Dead Horse | Yankee Jim's | Placer. |
| Defiance | New Coso | Inyo. |
| Del Norte Hydraulic. | Happy Camp | Del Norte. |
| Dense | Hornitos | Mariposa. |
| Derbec | North Bloomfield. | Nevada. |
| Dewey | Lowell Hill | Do. |
| Deadem | Meadow Valley | Plumas. |
| Dilts | Sherlocks | Mariposa. |
| Divolia Bonanza | Sonora | Tuolumne. |
| D. M. Laurin | Forbestan | Butte. |
| Dock Hill | Angels | Calaveras. |
| Dodson | Mooretown | Butte. |
| Dolly Varden | Greenwood | El Dorado. |
| Do | Glencoe | Calaveras. |
| Donnellan and Hagaman. | San Andreas | Do. |
| Donovan | Folsom | Sacramento. |
| Downs | Volcano | Amador. |
| Drift | Secret House | Placer. |
| Dry Creek Tunnel. | Igo | Shasta. |
| Dutch Company | Sierra | Sierra. |
| Early | Sweetwater | Mariposa. |
| Eastman | Lewiston | Trinity. |
| East New York | Lowell Hill | Nevada. |
| Do | Dutch Flat | Placer. |
| Eastern |  | Tuolumne. |
| Eastern Marine. | You Bet | Nevada. |
| Eastern Star | Shasta | Shasta. |
| Eclipse | Independence | Inyo. |
| Edward Stanokaer. | Orleans Bar | Del Narte. |
| Eggleston and Mowrey. | Downieville | Sierra. |
| Eldorado Mining Company | Placerville | El Dorado. |
| Elf | do | Do. |
| Elgin | Beveridge | Inyo. |
| Elizabethtown Flat. | Greenville | Plumas. |
| El Pemasko | Beveridge | Inyo. |
| Emigrant | Lee | Inyo. |
| Emma | Sylvania | Do. |
| Empire | Old Woman's Gulch. | Calaveras. |
| Do | Grass Valley | Nevada. |
| Empire Bar | Klamath River | Siskiyou. |
| English Tom | Lewiston | Trinity. |
| Enterprise | Hornitos | Mariposa. |
| Do | Lowell Hill | Nevada. |
| Esing & Company | Weaverville | Trinity. |
| Esperson | Fresno Flats | Fresno. |
| Essex | New Coso | Inyo. |
| Eureka | Tunnel Ridge | Calaveras. |
| Do | Georgetown | El Dorado. |
| Do | Blind Springs | Mono. |
| Do | North Bloomfield. | Nevada. |
| Do | Union | Inyo. |
| Excelsior | Smartsville | Yuba. |
| Do | Forest Hill | Placer. |
| Fairplay | Gibonsville | Sierra. |
| Feliciana | Sherlocks | Mariposa. |
| Fendingham | Camptonville | Sierra. |
| Fidelity | Glencoe | Calaveras. |
| Fignero and Ochoa. | Lone Pine | Inyo. |
| Fillibuster | Douglas City | Trinity. |
| Flagstaff | Swansea | Inyo. |
| Florence | Sierra | Sierra. |
| Flowers | Cañon Creek | Trinity. |
| Flower of Sunny Hill. | Igo | Shasta. |
| Foch | Callahan's | Siskiyou. |
| Foot and Thompson. | Rich Gulch | Calaveras. |
| Ford and Wright | Clarksville | El Dorado. |
| Fort Jones | Fort Jones | Siskiyou. |
| Foss | Gold Lake | Sierra. |
| Fortune | Callahan's | Siskiyou. |
| Four Hills | Sierra | Sierra. |
| Frank Young & Co. | Old Diggings | Shasta. |
| Franklin | Willow Valley | Nevada. |
| French | Indian Gulch | Mariposa. |
| French Company | Portwine | Sierra. |
| French Bar | Orleans Bar | Humboldt. |
| French Hill | Big Flat | Del Norte. |
| Freshour | Clamouth | Siskiyou. |
| Fresno Enterprise. | Fresno Flats | Fresno. |
| Frick and Davis | Lewiston | Trinity. |
| Friedman | Green Valley | El Dorado. |
| Frost and Reese | Mooretown | Butte. |
| Fulche and Bartlett. | Slabtown | Amador. |
| G. A. Mohr & Co. | Sawyer's Bar | Siskiyou. |
| Gardiner | Julian | San Diego. |
| Gardner & Co | Table Rock | Sierra. |
| Garfield | Calico | San Bernardino. |
| Do | Eureka Mills | Plumas. |
| Garland & Co | Berdan | Butte. |
| Garibaldi | Carson | Calaveras. |
| G. B. Pepper | Ballard's Bar | Yolo. |
| Genesee | Light's Cañon | Plumas. |
| Genette | Wild Rose | Inyo. |
| Georgia | Tunnel Ridge | Calaveras. |
| George Hearst | Modox Creek | Shasta. |
| George H. Gale | Mount House | Sierra. |
| Giant | Washington | Nevada. |
| Gignac | Placerville | El Dorado. |
| Gillicks and Phelps. | Jackson | Amador. |
| Gipsey King | New Coso | Inyo. |
| Gleason | Stockton Ridge | Calaveras. |
| Glencoe | Glencoe | Do. |
| Gold Blossom | Auburn | Placer. |
| Gold Cliff | Angels | Calaveras. |
| Gold Hill | Smith's Flat | El Dorado. |
| Gold King | Alleghany | Sierra. |

*List of the mines of the United States producing gold and silver*—Continued.

CALIFORNIA—Continued.

| Name of mine. | District. | County. |
|---|---|---|
| Gold Slate | Pinacate | San Diego. |
| Gold Stripe | Greenville | Plumas. |
| Gold Valley Hydraulic. | Poverty Hill | Sierra. |
| Golden Bull | Lowell | Placer. |
| Golden Eagle | Haydenville | Lassen. |
| Do | Mariposa | Mariposa. |
| Golden Era | Confidence | Tuolumne. |
| Golden Fleece | Deadwood | Placer. |
| Golden Gate | Iowa Hill | Do. |
| Golden Giant | Mountain City | Sierra. |
| Golden Star | Independence | Inyo. |
| Gonzales | Indian Gulch | Mariposa. |
| Good Hope | Glencoe | Calaveras. |
| Do | Pinacate | San Diego. |
| Gopher | Mock Hill | Calaveras. |
| Gordon Gulch | Weaverville | Trinity. |
| Gorilla | Homer | Mono. |
| Grand Rapids | Quartz Mountain. | Tuolumne. |
| Grand Victory | Diamond Springs | El Dorado. |
| Great Sierra | Tioga | Mono. |
| Green | Confidence | Tuolumne. |
| Green Mountain | Greenville | Plumas. |
| Do | Chili Gulch | Calaveras. |
| Do | Placerville | El Dorado. |
| Green Mountain Tunnel. | do | Do. |
| Grey Carbonate | Blind Springs | Mono. |
| Greyhound | Grass Valley | Nevada. |
| Grider | Happy Camp | Del Norte. |
| Grizzly | Pike City | Sierra. |
| Grizzly Gulch | Fort Jones | Siskiyou. |
| Grizzly Hill | Brandy City | Sierra. |
| Grove Bros | Greenville | Plumas. |
| Gunsight | Resting Springs | Inyo. |
| Gwin | Rich Gulch | Calaveras. |
| Hadly & Co | Volcano | Amador. |
| Hager & Co | Meadow Valley | Plumas. |
| Hagerman & Co | San Andros | Calaveras. |
| Half Dollar | Deep Springs | Fresno. |
| Halsey & Co | Volcano | Amador. |
| Halstead | Spanish Ranche | Plumas. |
| Hamill & Bloomer. | Forks of Salmon | Siskiyou. |
| Hamilton | White Oak | El Dorado. |
| Hampton | Fine Gold Gulch | Fresno. |
| Hanson | Greenwood | El Dorado. |
| Happy Camp | Happy Camp | Del Norte. |
| Hard Scrabble | Piety Hill | Shasta. |
| Harlem | Alleghany | Sierra. |
| Harrington and Andrews. | Washington | Calaveras. |
| Harvey Bros | Weaverville | Trinity. |
| Hartington and Hetherington. | Nevada City | Nevada. |
| Hathaway | Washington | Do. |
| Havens Gold Lake. | Downieville | Sierra. |
| Hawkeye | Sweet Gulch | Fresno. |
| Hayden Hill | Damascus | Placer. |
| Hayes Consolidated. | Junction City | Trinity. |
| Hazel Green | Sylvania | Inyo. |
| H. B. Nichols | Grass Valley | Nevada. |
| H. C | Happy Camp | Del Norte. |
| Headlock | Glencoe | Calaveras. |
| Hearsley & Philbrook. | Junction City | Trinity. |
| Healy and Van | Volcano | Amador. |
| Heslep | Quartz Mountain. | Tuolumne. |
| Henry | West Point | Calaveras. |
| Henry Clay | Lewiston | Trinity. |
| Hickeyes | do | Do. |
| Hidalgo | Beveridge | Inyo. |
| Hidden Treasure | Sunny South | Placer. |
| Hildreth | Fine Gold Gulch | Fresno. |
| Higman | Sherlocks | Mariposa. |

| Name of mine. | District. | County. |
|---|---|---|
| H. M. Place | Washington | Nevada. |
| Hoax | Shingle Springs | El Dorado. |
| Homeward Bound. | Iowa Hill | Placer. |
| Hong & Co | Weaverville | Trinity. |
| Hoosier Consolidated. | Jesus Maria | Calaveras. |
| H. U. Parberry & Co. | Volcano | Amador. |
| Humbug | Calico | San Bernardino. |
| Hunter | Auburn | Placer. |
| Ibex and Zebra | Saratoga | Inyo. |
| Idaho | Grass Valley | Nevada. |
| Ignacio | Cerro Gordo | Inyo. |
| Independence | Clipper Flat | Sierra. |
| Do | New Coso | Inyo. |
| Indiana | Swansea | Do. |
| Indian Creek | Douglas City | Trinity. |
| Indian Hill | Gold Run | Placer. |
| Indian Queen | Blind Springs | Mono. |
| Indian Spring | Minshew | Butte. |
| Indian Valley | Greenville | Plumas. |
| Invincible | Angels | Calaveras. |
| Iowa | Sutter Creek | Amador. |
| Iron Clad | Rough and Ready. | Nevada. |
| Isaac Woodbury | Weaverville | Trinity. |
| Isola | Lewiston | Do. |
| Jackson | Central Hill | Calaveras. |
| Do | Willow Valley | Nevada. |
| Do | Jackson | Amador. |
| Jackson and Curry. | Cottonwood | Siskiyou. |
| Jake Winans | Fur Cap | Sierra. |
| James Butts | Ophir | Placer. |
| James Jordan | Michigan Bar | Sacramento. |
| James Hall | Volcano | Amador. |
| James Shiler | do | Do. |
| Jamison & Co | Eureka | Plumas. |
| Jersey | Forest Hill | Placer. |
| John Brown | Michigan Bar | Sacramento. |
| John Mahoney | Folsom | Do. |
| John Smith | Lewiston | Trinity. |
| John S. Lowden | Hamburg Bar | Siskiyou. |
| John Young | Oro Fino | Do. |
| John Williams | Folsom | Sacramento. |
| Johnston | Cox's Bar | Trinity. |
| Josephine | Smith's Flat | El Dorado. |
| Do | Coso | Inyo. |
| Joubert | Slate Range | Trinity. |
| Journey | Nevada City | Nevada. |
| J. & P. Sheridan | Junction City | Trinity. |
| J. S. Stephens | Slate Range | Yuba. |
| Junction | Clipper Flat | Sierra. |
| Jupiter | Dogtown | Calaveras. |
| J. W. Whitney | Volcano | Amador. |
| Kanaka | Klamath River | Siskiyou. |
| Kay & Co | Shingle Springs | El Dorado. |
| Kearsarge | Calico | San Bernardino. |
| Kelly | Hunt's Gulch | Amador. |
| Kempton | Shasta | Shasta. |
| Kerchman's | Nevada City | Nevada. |
| Keynot | Beveridge | Inyo. |
| Keystone | Amador | Amador. |
| Kinders | Gold Run | Placer. |
| King | Calico | San Bernardino. |
| King and Wiseman. | Washington | Plumas. |
| King's Gulch | King's Gulch | Fresno. |
| Kinshew | Kinshewtown | Butte. |
| Klamath | Lowers Bar | Siskiyou. |
| Knap, Birney & Co. | Columbia | Tuolumne. |
| Knapper | Forbestown | Butte. |
| Knapper Bar | Klamath River | Siskiyou. |
| Knowles | Lewiston | Trinity. |

*List of the mines of the United States producing gold and silver*—Continued.

CALIFORNIA—Continued.

| Name of mine. | District. | County. |
|---|---|---|
| Knox Bros | Sonora | Tuolumne. |
| Kookham & Hitchcock. | Blue Tent | Nevada. |
| Kuhwas | Humbug | Siskiyou. |
| La Cachora | Beveridge | Inyo. |
| La Cueva | ....do | Do. |
| La Fayette | Grab Gulch | Fresno. |
| La Grange | Lagrange | Stanislaus. |
| Lain | Happy Camp | Del Norte. |
| Laird | Rocklin | Placer. |
| La Monte | Mineral | Butte. |
| Lamphear | Mokelumne Hill | Calaveras. |
| Lamphere | Quartz Mountain | Tuolumne. |
| Lasky | Beveridge | Inyo. |
| Last Camp | Blue Cañon | Placer. |
| Last Chance | Fine Gold Gulch | Fresno. |
| Do | Howland | Sierra. |
| Laura | Beveridge | Inyo. |
| Laws and Gilgean | Junction City | Trinity. |
| Lebanon | Wisconsin Hill | Placer. |
| Lecompton | Nevada City | Nevada. |
| Le Frenchi | Glencoe | Calaveras. |
| L. E. Stewart | Bronson | Tuolumne. |
| Lewis Bros | Downieville | Sierra. |
| Lewis & Griffith | Damascus | Placer. |
| Lewis & Wheelers. | Grass Valley | Nevada. |
| Liberty Hill | Remington Hill | Do. |
| Lime Gulch | Klamath River | Siskiyou. |
| Lincoln | Sutter Creek | Amador. |
| Do | Grass Valley | Nevada. |
| Lindsey | Angels | Calaveras. |
| Lizzie Bullock | Ivanpah | San Bernardino. |
| Lone Jack | Kelsey | El Dorado. |
| Lone Queen | Blind Springs | Mono. |
| Lone Star | West Point | Calaveras. |
| Loganine | Sierra City | Sierra. |
| Long Bros | Humbug | Siskiyou. |
| Long Island | Klamath | Do. |
| Long Tom | Long Tom | Inyo. |
| Lookout | Modoc | Do. |
| Los Angelos | Beveridge | Do. |
| Lost Confidence | Iron Mountain | Shasta. |
| Lorenze | Junction City | Trinity. |
| Louisiana | Sonora | Tuolumne. |
| Lowell | Lowell Hill | Nevada. |
| Loyal | Dry Town | Amador. |
| Lucky Bill | Fresno Flats | Fresno. |
| Lucky Jim | New Coso | Inyo. |
| Lyon | Prospect Flats | El Dorado. |
| M. Klein | Lewiston | Trinity. |
| M. Welch | Shasta | Shasta. |
| Mad Ox | Whiskeytown | Do. |
| Magenta | Grass Valley | Nevada. |
| Maggie Johnson | Catheys Valley | Mariposa. |
| Malone | Sherlocks | Do. |
| Mammoth | Jackson | Amador. |
| Do | Tunnel Ridge | Calaveras. |
| Marguerite | Grass Valley | Nevada. |
| Do | Logansville | Sierra. |
| Mammoth | Bully Chopp | Shasta. |
| Marion | Whiskey Town | Do. |
| Mapleson & Co | Hamburg Bar | Siskiyou. |
| Markuson & Knudson. | Orleans Bar | Humboldt. |
| Marks & Co | Slate Range | Yuba. |
| Marshall | Angels | Calaveras. |
| Martin Keefe | Trinity | Siskiyou. |
| Martin Welch | Michigan Bar | Sacramento. |
| Martin & Co | Michigan Hill | Plumas. |
| Mascotte | Grass Valley | Nevada. |
| Marhewson | Fort Jones | Siskiyou. |
| Maxson | Beveridge | Inyo. |
| Mayflower | Forest Hill | Placer. |
| May Lundy | Homer | Mono. |
| May Queen | Pinacate | San Diego. |
| McConnell | Callahan's | Siskiyou. |
| McCormicks | Grass Valley | Nevada. |
| McCann | Sherlocks | Mariposa. |
| McCrosby | Volcano | Amador. |
| McCullough | Grass Valley | Nevada. |
| McElroy | Bald Hill | Calaveras. |
| McGary & Grey | Clarksville | Eldorado. |
| McKinley & Gilbert. | Butcher Ranch | Placer. |
| McLaughlin | Volcano | Amador. |
| McMurray & Happ. | Weaverville | Trinity. |
| McNesbit | Oregon Gulch | Butte. |
| McPhearson & Hilton. | Saw Mill Flat | Tuolumne. |
| McSorley | Okelumne | Calaveras. |
| Melonese Consolidated. | Carson | Do. |
| Meridith | Minshew | Butte. |
| Meritus | Copperopolis | Calaveras. |
| Merifee | Poorman | San Diego. |
| Merrifield | Grass Valley | Nevada. |
| Merrimac | Central Hill | Calaveras |
| Mexican | Glencoe | Do. |
| Mexico | ....do | Do. |
| Meyer and Kuchenback. | Callahan's | Siskiyou. |
| Michael Walker | Forks of Salmon | Do. |
| Milton | North Bloomfield. | Nevada. |
| Do | Grizzly Flat | El Dorado. |
| Miocene | Mooretown | Butte. |
| Mitchell | Vallecito | Calaveras. |
| Minnesota | Lewiston | Trinity. |
| Mississippi | Big Oak | Tuolumne. |
| Modden | Smith's Flat | El Dorado. |
| Modoc | Modoc | Inyo. |
| Do | Grey Gulch | Amador. |
| Mohawk | Wild Rose | Inyo. |
| Do | Iowa Hill | Placer. |
| Monarch | Dog Town | Calaveras. |
| Mondado | Camptonville | Yuba. |
| Monitor | Greenville | Plumas. |
| Monte Christo | Glencoe | Calaveras. |
| Monte De Oro | Oroville | Butte. |
| Monel Consolidated. | Greenwood | Eldorado. |
| Montezuma | Union | Inyo. |
| Do | Callahan's | Siskiyou. |
| Do | Lewiston | Trinity. |
| Mooney | Whiskey Hill | Tuolumne. |
| Morning Star | Auburn | Placer. |
| Do | Iowa Hill | Do. |
| Morgan | Carson | Calaveras. |
| Do | Remington Hill | Nevada. |
| Morris | Oroville | Butte. |
| Morristown | Trinity Centre | Trinity. |
| Morton | Taylorville | Plumas. |
| Motor | Brownsville | Yuba. |
| Mount Auburn | Grass Valley | Nevada. |
| Mount Gaines | Hornitos | Mariposa. |
| Mount Pleasant | Grizzly Flat | El Dorado. |
| Mount Turolus | Jesus Maria | Calaveras. |
| Mountain Gate | Damascus | Placer. |
| Mountain View | Fine Gold | Fresno. |
| Mountaineer | Grass Valley | Nevada. |
| Mozart | Calico | San Bernardino. |
| Muck-a-muck | Happy Camp | Del Norte. |
| Mugginsville | Fur Cap | Sierra. |
| Murchie | Grass Valley | Nevada. |
| Murphy and Mattison. | Cañon Creek | Trinity. |
| Murphy & Son | ...do | Do. |
| Murray | Flat Creek | Shasta. |
| Nashville | Nashville | Eldorado. |
| Nevada | Gibsonville | Sierra. |
| Do | Brownsville | Yuba. |
| Nevada City | Grass Valley | Nevada. |
| New Jersey Drift | Forest Hill | Placer. |
| New York Hill | Grass Valley | Nevada. |

*List of mines of the United States producing gold and silver*—Continued.

CALIFORNIA—Continued.

| Name of mine. | District. | County. |
|---|---|---|
| Niagara Consolidated. | Hepsidam | Sierra. |
| Nichol and Longby. | John Adams | Amador. |
| Nichols and Russell. | Grass Valley | Nevada. |
| Nixon & Co | Volcano | Amador. |
| Noonday | Bodio | Mono. |
| North Bloomfield | North Bloomfield | Nevada. |
| North Noonday | Bodie | Mono. |
| Norwich | Glencoe | Calaveras. |
| Oak | Placerville | Eldorado. |
| Oak Grove | Fort Jones | Siskiyou. |
| Ochre | Drytown | Amador. |
| O'Connell | Reading Creek | Trinity. |
| Ohio Consolidated | West Point | Calaveras. |
| O. K | Murphys | Do. |
| Old City | Hornitos | Mariposa. |
| Old Coyle | Trinity Creek | Trinity. |
| Old French | West Point | Calaveras. |
| Old Jolly | Trinity | Trinity. |
| Old Judge | Douglas | Calaveras. |
| Old Variety | Modoc | Inyo. |
| Olsen | La Grange | Stanislaus. |
| Orleans | Grass Valley | Nevada. |
| O nega | Washington | Do. |
| Orentt | | Tuolumne. |
| Oriental | Calico | San Bernardino. |
| Original Creek Hydraulic. | Monoville | Mono. |
| Original Empire | Grass Valley | Plumas. |
| Orion | Iowa Hill | Placer. |
| Oro Fino | Blind Springs | Mono. |
| Oro Plato | Murphys | Calaveras. |
| Orono Drift | Bath | Placer. |
| Orr & Co | Hungarian Hill | Plumas. |
| Otis & Mayne | Quartz | Do. |
| Paddy Jack | Beveridge | Inyo. |
| Parberry & Co | Volcano | Amador. |
| Paragon | Bath | Placer. |
| Park | Placerville | El Dorado. |
| Pacific | Smith's Flat | Do. |
| Pan Wicket | Reading Creek | Trinity. |
| Pame ia | Blind Springs | Mono. |
| Parson | Smith's Flat | El Dorado. |
| Patterson | Coloma | Do. |
| Do | Cox's Bar | Trinity. |
| Do | | Tuolumne. |
| Pay Creek | Murphy's | Calaveras. |
| Penobscot | Tunnel Ridge | Do. |
| Perch | Orleans Bar | Humboldt. |
| Pershbacker | Minshew | Butte. |
| Peterson | Happy Camp | Del Norte. |
| P. D. Eckart | Folsom | Sacramento. |
| Phillips | Lewiston | Trinity. |
| Phil Mott Company. | Klamath River | Siskiyou. |
| Phœnix | New Coso | Inyo. |
| Do | Whiskey Town | Shasta. |
| Pike County Bar. | Douglas City | Trinity. |
| Pierre | Copperopolis | Calaveras. |
| Pincarte | Cotton | San Diego. |
| Pine Log | Copperopolis | Calaveras. |
| Pine Park | Tunnel Ridge | Do. |
| Pioneer | Saint Louis | Sierra. |
| Piute | Bishop's Creek | Inyo. |
| Planet | Lowell Hill | Nevada. |
| Pleasant Valley | Diamond Springs | El Dorado. |
| Plumas Consolidated. | Greenville | Plumas. |
| Plumas Eureka | Eureka Mills | Do. |
| Plumbago | Minnesota | Sierra. |
| Plunkett | Clarksville | El Dorado. |
| Plymouth Consolidated. | Plymouth | Amador. |
| Polito | Bishop's Creek | Inyo. |
| Poorman | West Point | Calaveras. |
| Potosi | Kearsarge | Inyo. |
| Portugese | Brownsville | Yuba. |
| Potter | Angels | Calaveras. |
| Poverty Hill | Scales | Sierra. |
| Price | Cox's Bar | Trinity. |
| Pride of the West | West Point | Calaveras. |
| Primrose | Clipper Flat | Sierra. |
| Pritchard | Iowa Hill | Placer. |
| Prussian Hill | West Point | Calaveras. |
| Providence | Grass Valley | Nevada. |
| Do | Shirt Tail Canyon | Placer. |
| Raccoon Bar | French Bar | Humboldt. |
| Rainbow | Clipper Flat | Sierra. |
| Raspberry | Angels | Calaveras. |
| Rasalia | Gabilan | San Diego. |
| Ratston | Pennsylvania Flat. | Placer. |
| Real Del Norte | New Coso | Inyo. |
| Reardon | Minersville | Trinity. |
| Red Cap Bar | Orleans Bar. | Humboldt. |
| Red Cloud | Colterville | Mariposa. |
| Red Lion | Deep Springs | Inyo. |
| Red Wing | Murphy's. | Calaveras. |
| Reed | Bishop's Creek | Inyo. |
| Reed & Van Metre | Minersville | Trinity. |
| Regare | Copperopolis | Calaveras. |
| Rex Montis | Kearsarge | Inyo. |
| Rich Gulch | Georgetown | El Dorado. |
| Richards & Co | Fur Cap | Sierra. |
| Riffle | Columbia | Tuolumne. |
| Riley | Guston Hill | Calaveras. |
| Rip Van Winkle | Greenwood | El Dorado. |
| Rising Star | Central Hill | Calaveras. |
| Rising Sun | Alleghany | Sierra. |
| Do | Cherokee | Tuolumne. |
| Riverside | American Camp | Do. |
| Roanoke | Kearsarge | Inyo. |
| Robert Elliott | Cottage Grove | Del Norte. |
| Roberts & Kendall. | Forbestown | Butte. |
| Rock Creek | Poverty Hill | Sierra. |
| Rock Island | Buck's Ranch | Plumas. |
| Rollins | Sweetwater | Mariposa. |
| Rosencrantz | Georgetown | El Dorado. |
| Roses & Sanches | Hornitos | Mariposa. |
| Rough Diamond | Chelly Gulch | Calaveras. |
| Rule | Weaverville | Trinity. |
| Ruby | Forest City | Sierra. |
| Sacramento | Rocklin | Placer. |
| Sailor Jack | Shingle Springs | Calaveras. |
| Saints' Rest | Orleans Bar | Humboldt. |
| Saint Julian | Hunt's Gulch | Amador. |
| Saint Patrick | Lincoln | Placer. |
| Do | Ophir | Do. |
| San Andreas | Guston Hill | Calaveras. |
| Do | San Andreas | Do. |
| San Bruno | Glencoe | Do. |
| San Diego | Beveridge | Inyo |
| San Francisco | Forest Hill | Placer. |
| San Ignacio | Beveridge | Inyo |
| San Jacinto | Gabilan | San Diego. |
| San Lucas | Cerro Gordo | Inyo. |
| San Pedro | Gleneae | Calaveras. |
| Santa Domingo | Honitos | Mariposa. |
| Santa Maria | Brunson | Tuolumne. |
| Savorom | Orleans Bar. | Humboldt. |
| Schroder | Sherlocks | Mariposa. |
| Schultz | Happy Camp | Del Norte. |
| Scorpion | West Point | Calaveras. |
| Scott, Brody & Greenleaf. | Deep Springs | Inyo. |
| Seaton | Dogtown | Amador. |
| S ll | Fort Jones | Siskiyou. |
| Shanway | Forks of Salmon | Do. |
| Shallow (placers) | Lovelocks | Butte. |
| Shawmut | Blue Gulch | Tuolumne. |
| Do | Kearsarge | Inyo. |
| Sheep Ranch | Washington | Calaveras. |
| Shelor & Co | Volcano | Amador. |
| Shenandoah | Calico | San Bernardino. |
| Do | San Diego | San Diego. |

*List of mines of the United States producing gold and silver*—Continued.

CALIFORNIA—Continued.

| Name of mine. | District. | County. |
|---|---|---|
| Shepley | Ophir | Placer. |
| Sheridan | Junction City | Trinity. |
| Shirtleff | Auburn | Placer. |
| Shoo Fly | Trinity Centre | Trinity. |
| Sierra Buttes | Sierra City | Sierra. |
| Sierra W. & M. Company. | Table Rock | Do. |
| Singleton & Co | Hamburg Bar | Siskiyou. |
| Silver | Modoc | Inyo. |
| Silver Odessa | Calico | San Bernardino. |
| Silver Sprout | Kearsarge | Inyo. |
| Skewis & Sons | Minersville | Trinity. |
| Skunk's Point | Big Bar | Do. |
| Slate Range | Sylvania | Inyo. |
| Slate Ledge | Grass Valley | Nevada. |
| Smith's Flat | Douglas City | Do. |
| Snow | Newton | El Dorado. |
| Snow Peak | Back Bone | Shasta. |
| Sonnett | Columbia | Tuolumne. |
| Soulsby | Soulsbyville | Do. |
| South Yuba W. & M. | You Bet | Nevada. |
| Spangle Gold | Spangle Gold | Fresno. |
| Springfield | White Oak | Calaveras. |
| Spring Valley | Cherokee Flats | Butte. |
| Squires | Gibbonsville | Sierra. |
| Standard | Bodie | Mono. |
| Stanly & White | Brunson | Tuolumne. |
| Starr King | Soulsbyville | Do. |
| Star of the West | West Point | Calaveras. |
| Staten & Co | Columbia | Tuolumne. |
| Steel & Co | Hamburg Bar | Siskiyou. |
| Steiner's Flat | Douglas City | Trinity. |
| Stella | Mogul | Alpine. |
| Sterling | Copperopolis | Calaveras. |
| Stewart & Crocker | Brunson | Tuolumne. |
| Stewart & Short | Fort Jones | Siskiyou. |
| Stickler | Angels | Calaveras. |
| Stockton | Gray Gulch | Amador. |
| Do | Fine Gold Gulch | Fresno. |
| Story | Copperopolis | Calaveras. |
| Strawberry | Monona Flat | Placer. |
| Sucker Flat | do | Do. |
| Suffolk | Saint Lavis | Sierra. |
| Sunnyside | Murphy's | Calaveras. |
| Sumner | Kernville | Kern. |
| Summers | Patterson | Mono. |
| Surprise | Grab Gulch | Fresno. |
| Swansea Belle | Swansea | Inyo. |
| Sweetland | Sweetland | Nevada. |
| Swiss Bar | Klamath River | Siskiyou. |
| Syndicate | Bodie | Mono. |
| Table Mountain | Cave City | Calaveras. |
| Table Rock | Howland Flat | Sierra. |
| Ten Eyck | Flat Creek | Shasta. |
| Texas Flat | Michigan Hill | Plumas. |
| Do | Coarse Gold | Fresno. |
| Tiger | Rich Gulch | Calaveras. |
| Tom White | Piety Hill | Shasta. |
| Tompkins | Fort Jones | Siskiyou. |
| Tower | Blind Springs | Mono. |
| Trade Dollar | Deep Springs | Inyo. |
| Trinity | Weaverville | Trinity. |
| Trinity Hydraulic. | Big Bar | Do. |
| Troxell & Co | Table Rock | Sierra. |
| True Business | Beveridge | Inyo. |
| Tucker | West Point | Calaveras. |
| Turkey Hill | Michigan Bluff | Placer. |
| Tutt's | Light's Cañon | Plumas. |
| Uncle Sam | Sylvania | Inyo. |
| Do | Eddy's Gulch | Siskiyou. |
| Union | Iowa Hill | Placer. |
| Do | Scales | Sierra. |
| Union Consolidated. | Gibbonsville | Do. |
| Union Hill Hydraulic. | Scales Diggins | Do. |
| Union Gold Bluff | Trinidad | Humboldt. |
| Union and Santa Maria. | Cerro Gordo | Inyo. |
| Valentine | Glencoe | Calaveras. |
| Do | Quartz Township. | Plumas. |
| Vance Bros | Big Bar | Trinity. |
| Vatican | Plymouth | Amador. |
| Vermont | Lewiston | Trinity. |
| Virginia | Colterville | Mariposa. |
| Virginia Creek Hydraulic. | Bodie | Mono. |
| Vitura | Lewiston | Trinity. |
| Volcano | Volcano | Amador. |
| Volunteer | Oro Fino | Siskiyou. |
| W. A. Pattison | Big Bear | Trinity. |
| Wabash | Amador | Amador. |
| Waco Star | Independence | Inyo. |
| Wah Yeu | Morse Flat | Nevada. |
| Walker | Greenwood | El Dorado. |
| Do | Forks of Salmon | Siskiyou. |
| Washington | Murphy's | Calaveras. |
| Waterman & Porter. | Waterman | San Bernardino. |
| Waukesha | Bloomfield | Nevada. |
| Waywery | Blind Springs | Mono. |
| Weed's Point | Slate Range | Yuba. |
| Weske | Iowa | Placer. |
| Wheelock & Rodgers. | Washington | Calaveras. |
| Whidden | Shingle Springs | El Dorado. |
| White | Shasta | Shasta. |
| Whiskey | West Point | Calaveras. |
| Whiskey Hill | Damascus | Placer. |
| Whiteman | Butcher Ranche | Do. |
| White Wing | Murphy,s | Calaveras. |
| Whiting & Co | Volcano | Amador. |
| Whitlock | Sherlock's | Mariposa. |
| Wide West | Canada Hill | Nevada. |
| Williams | Whiskey Town | Shasta. |
| William Barns | Sawyer's Bar | Siskiyou. |
| Wilshire | Cox's Bar | Trinity. |
| Williams and Popple. | White River | Tuolumne. |
| Win Chung & Co. | Weaverville | Trinity. |
| Wingate | Happy Camp | Del Norte. |
| Winselman & Co | Slate Range | Yuba. |
| Wisconsin | Forest City | Sierra. |
| Do | Minnesota | Do. |
| Wiseman & King. | Quartz Township | Plumas. |
| Woodchuck | Downiesville | Sierra. |
| Woodcock | Glencoe | Calaveras. |
| Wolverine | Railroad Flat | Do. |
| Wright & Fletcher. | Oro Fino | Siskiyou. |
| W. V. Clark | Railroad Flat | Calaveras. |
| Wyatt & Doak | Big Dry Creek | Fresno. |
| Yankee Blade | Modoc | Inyo. |
| Yosemite | Quartz Mountain | Tuolumne. |
| Yuba | Washington | Nevada. |
| Yuba River | Blue Tent | Do. |
| Zeile | Jackson | Amador. |
| J. W. Zent | Shasta | Shasta. |

*List of the mines of the United States producing gold and silver*—Continued.

COLORADO.

| Name of mine. | District. | County. |
|---|---|---|
| Actna | Leadville | Lake. |
| Adams | do | Do. |
| Aetna | do | Do. |
| Ajax | San Miguel | San Miguel. |
| Alamakce | Gold Hill | Boulder. |
| Alaska | Silverton | San Juan. |
| Albert | Bonanza | Saguache. |
| Alice | Fall River | Clear Creek. |
| Alma | Hall's Gulch | Park. |
| Amboy | Tin Cup | Gunnison. |
| Amsborough | San Miguel | San Miguel. |
| American | Central | Boulder. |
| Americus | do | Gilpin. |
| Amie | Leadville | Lake. |
| Anna Derica | Tin Cup | Gunnison. |
| Anna Mountain | do | Do. |
| Antioch | Leadville | Lake. |
| Argent | do | Do. |
| Argentine | do | Do. |
| Do | San Miguel | San Miguel. |
| Argo | Central | Boulder. |
| Aspen | Hazelton | San Juan. |
| Atlantic | Red Mountain | Ouray. |
| Do | Eureka | San Juan. |
| Augusta | Poverty Gulch | Gunnison. |
| Aurora | Central | Gilpin. |
| A. Y | Leadville | Lake. |
| Aztec | do | Do. |
| Do | Summit | Rio Grande. |
| Do | Pioneer | Dolores. |
| Badger | Tin Cup | Gunnison. |
| Baltimore Belle | Central | Boulder. |
| Baltimore Tunnel | Brown Mountain | Clear Creek. |
| Baraconta | Clear Creek | Chaffee. |
| Bassick | Silver Cliff | Custer. |
| Baxter | Griffith | Deer Creek. |
| Beaver Creek | Beaver Creek | Park. |
| Belcher | Silverton | San Juan. |
| Belden | Red Cliff | Eagle. |
| Bella | Gold Hill | Boulder. |
| Belle East | Union | Summit. |
| Belle of the Animas. | Eureka | San Juan. |
| Belle of the West. | Lake | Hinsdale. |
| Ben Franklin | Eureka | San Juan. |
| Big Bonanza | Chalk Creek | Chaffee. |
| Big Casino | Galena | Hinsdale. |
| Big Chief | Sneffles | Ouray. |
| Do | Leadville | Lake, |
| Big Manitou | Bonanza | Saguache. |
| Big Thing | Central | Boulder. |
| Bismarck | Sherman Mt | Clear Creek. |
| Black Bear | Spanish Bar | Do. |
| Black Cloud | Gold Hill | Boulder. |
| Black Hawk | Pioneer | Dolores. |
| Do | Pennsylvania Gulch. | Park. |
| Black Iron | Red Cliff | Eagle. |
| Black Prince | Leadville | Lake. |
| Blackstone | Red Mountain | Ouray. |
| Blanche | Montezuma | Summit. |
| Blue River | Blue River | Do. |
| Bob Tail | Bob Tail Hill | Gilpin. |
| Bonanza | Eureka | San Juan. |
| Bonanza and Union Tunnel. | Bob Tail Hill | Gilpin. |
| Bonanza Tunnel. | Democrat Mt | Clear Creek. |
| Bonanza King | Beaver Creek | Park. |
| Boreel | Leadville | Lake. |
| Boss | Nevada | Gilpin. |
| Boss Mammoth | Bonanza | Saguache. |
| Boulder Nest | Argentiferous | Clear Creek. |
| Bratly | San Miguel | San Miguel. |
| Breece Iron | Leadville | Lake. |
| Brian Boru | do | Do. |
| Brittenstein | Chalk Creek | Chaffee. |
| Brookland | Leadville | Lake. |
| Buckeye | do | Do. |
| Buckhorn | Crystal Hill | Saguache. |
| Buena | Central | Boulder. |
| Bull Durango | Silver Cliff | Custer. |
| Bull of the Woods | Central City | Gilpin. |
| Burleigh | Griffith | Clear Creek. |
| Burlington | Ruby | Gunnison. |
| Bunker Hill | Union | Summit. |
| Butler | Iron Springs | San Juan. |
| Caborfeigle | Poverty Gulch | Gunnison. |
| California | Nevada | Gilpin. |
| Calumet | Bonanza | Saguache. |
| Camp Bird | Conundrum | Pitkin. |
| Capitol City | Galena | Hinsdale. |
| Carbonate Hill | Leadville | Lake. |
| Carbonate King | Red Mountain | Ouray. |
| Caribou | Iron Springs | San Miguel. |
| Do | Caribou | Boulder. |
| Caroline | Uncompahgre | Ouray. |
| Carruthers & Hinman. | Poverty Bar | Routt. |
| Cashier | Empire | Clear Creek. |
| Catalpa | Leadville | Lake. |
| Celestial | Ward | Boulder. |
| Centennial | Montgomery | Park. |
| Century | California | La Plata. |
| Do | Salina | Boulder. |
| Champion | Idaho Springs | Clear Creek. |
| Do | Red Mountain | Ouray. |
| Champion Tunnel | Eagle | Summit. |
| Charter Oak | Nevada | Gilpin. |
| Do | Red Mountain | Ouray. |
| Chatauqua | Snake River | Summit. |
| Chattanooga | Red Mountain | Ouray. |
| Chestnut | Pioneer | Dolores. |
| Chicago | Tomichi | Gunnison. |
| Christine Nillson | Gold Basin | Do. |
| Chrysolite | Leadville | Lake. |
| Do | Chalk Creek | Chaffee. |
| Cimarron | San Miguel | San Miguel. |
| Cincinnati | do | Do. |
| Do | Union | Summit. |
| Clarence | Buena Vista | Chaffee. |
| Clay County | Central | Gilpin. |
| Cleveland | Leadville | Lake. |
| Do | Red Cliff | Eagle. |
| Clift | Democrat Mt | Clear Creek. |
| Climax | Leadville | Lake. |
| Clinton | Red Cliff | Eagle. |
| Cliosophis | Printer Boy Hill | Lake. |
| Clontarf | Leadville | Do. |
| Coaly | Union | Summit. |
| Colfax | Central | Boulder. |
| Collateral | Leadville | Lake. |
| Colonel Sellers | do | Do. |
| Colorado Central | Griffith | Clear Creek. |
| Colorado Mt. Cf. | Monarch | Chaffee. |
| Colorado United | Brown Mt | Clear Creek. |
| Columbus | Monarch | Chaffee. |
| Columbia | Bonanza | Saguache. |
| Combined Discovery. | Red Cliff | Eagle. |
| Commodore | Union | Summit. |
| Congress | Red Mountain | Ouray. |
| Do | Silverton | San Juan. |
| Cornucopia | Hawley Gulch | Saguache. |
| Crescent | Leadville | Lake. |
| Cross | Pioneer | Dolores |
| Crown Point | Leadville | Lake. |
| Do | Ten Mile | Summit. |
| Do | Red Cliff | Eagle. |
| Cotton | Bob Tail Hill | Gilpin. |
| Crœsus | Fletcher's Mt | Summit. |
| Crookes | Lake City | Hinsdale. |
| Crystal | Idaho Springs | Clear Creek. |
| Crystal Hill | Central | Boulder. |
| Cumberland | Tin Cup | Gunnison. |
| Do | California | La Plata. |
| Cyclops | Enterprise | Gilpin. |
| Dandy | Cottonwood | Boulder. |
| Danedin | Griffith | Clear Creek. |

*List of the mines of the United States producing gold and silver*—Continued.

COLORADO—Continued.

| Name of mine. | District. | County. |
|---|---|---|
| Daniel Webster | Silverton | San Juan. |
| Danser | Mosquito | Park. |
| Dawson | Taylor | Eagle. |
| Deadwood | Iron Springs | San Miguel. |
| Decatur | Russell | Gilpin. |
| December | Central | Boulder. |
| Deer Lodge | Leadville | Lake. |
| Delaware | Union | Summit. |
| Delmino | Red Mountain | Ouray. |
| Denver | Nevada | Gilpin. |
| Denver City | Leadville | Lake. |
| Dexter | do | Do. |
| Do | Uncompahgre | Ouray. |
| Diamond Tunnel | Republican Mt | Clear Creek. |
| Dinero | Leadville | Lake. |
| Dolobran | Telluride | San Miguel. |
| Dolphin | Leadville | Lake. |
| Domingo | Poverty Gulch | Gunnison. |
| Double Decker | Leadville | Lake. |
| Douglass | Tin Cup | Gunnison. |
| Drew | do | Do. |
| Dunderberry | Sherman Mt | Clear Creek. |
| Dunkin | Leadville | Lake. |
| Dutchman | Nevada | Gilpin. |
| Dyer | Leadville | Lake. |
| Eagle | Taylor | Eagle. |
| Eagle Bird | Red Cliff | Do. |
| East Flock | Bald Mountain | Gilpin. |
| Eclipse | Monarch | Chaffee. |
| Egyptian | Nevada | Gilpin. |
| El Capitan | Tin Cup | Gunnison. |
| Ella D | Pioneer | Dolores. |
| Ellen | Central | Boulder. |
| Elkhorn | Union | Summit. |
| Emancipation | Gold Hill | Boulder. |
| Emma | Poverty Gulch | Gunnison. |
| Emma Mountain | Red Mountain | Ouray. |
| Empire | Silverton | San Juan. |
| Empire City | Empire | Clear Creek. |
| Empress Josephine. | Bonanza | Saguache. |
| Equator | Griffith | Clear Creek. |
| Equitable | do | Do. |
| Erskine McClellan. | Leavenworth Mt | Do. |
| Esperanza | Crystal Hill | Saguache. |
| Eureka | Treasury Mt | Gunnison. |
| Do | Montezuma | Summit. |
| Evans | San Miguel | San Miguel. |
| Evening Star | Leadville | Lake. |
| Everlasting | Buckskin | Park. |
| Excelsior | Poverty Gulch | Gunnison. |
| Exchange. | Red Mountain | Ouray. |
| Fairburg | Montgomery | Park. |
| Fairplay | Monarch | Chaffee. |
| Fanny | Enterprise | Gilpin. |
| Fanny Barrett | Mosquito | Park. |
| Fanny Wyatt | Cottonwood | Chaffee. |
| Financier | Cascade | Clear Creek. |
| First Centennial | Quartz Valley | Gilpin. |
| First National | Printer Boy Hill | Lake. |
| Flora Belle | Chalk Creek | Chaffee. |
| Florence | Leadville | Lake. |
| Forest City | do | Do. |
| Forest Queen | Ruby | Gunnison. |
| Do | Everett | Lake. |
| Forget-me-not | Bald Mountain | Gilpin. |
| Forsaken | Leadville | Lake. |
| Fourth of July | Seaton Mountain | Clear Creek. |
| Fox | Iron Springs | San Miguel. |
| Frank Hough | Galena | Hinsdale. |
| Franklin | Sugar Loaf | Boulder. |
| Do | Silver Park | Custer. |
| Fredonia | Union | Summit. |
| Freeland | Trail Creek | Clear Creek. |
| French Boys | Silverton | San Juan. |
| Gaff | Hope | Chaffee. |
| Galena | Red Mountain | Ouray. |
| Do | Central | Gilpin. |
| Galena Lion | Red Mountain | Ouray. |
| Galena Queen | do | Do. |
| Galena and Delaware. | Breckenridge | Summit. |
| Garibaldi | Iron Springs | San Miguel. |
| Gaston | Red Mountain | Ouray. |
| Gem | Ruby | Gunnison. |
| Do | Idaho Springs | Clear Creek. |
| Gem City | Montezuma | Summit. |
| Gennessee | Red Mountain | Ouray. |
| George D. Roberts | Tin Cup | Gunnison. |
| Germania | Ten Mile | Summit. |
| Gerald Griffin | Leadville | Lake. |
| Gettysburgh | Central | Gilpin. |
| Gilpin Burroughs | Nevada | Eagle. |
| Gilt Edge | Leadville | Lake. |
| Gladstone | Chalk Creek | Chaffee. |
| Glasgow | Cochetopa | Gunnison. |
| Glass Pendery | Leadville | Lake. |
| Glen Cove | La Plata | Chaffee. |
| Globe | Iron Springs | San Miguel. |
| Golconda | Summit | Rio Grande. |
| Gold Cup | Tin Cup | Gunnison. |
| Gold Field | Chalk Creek | Chaffee. |
| Gold King | Central | Boulder. |
| Do. | San Miguel | San Miguel. |
| Gold Monument | Pitkin | Gunnison. |
| Gold Park | Holy Cross | Eagle. |
| Goldsmith | Pitkin | Gunnison. |
| Golden Age | Central | Boulder. |
| Golden Star | Montgomery | Park. |
| Gone Abroad | Leadville | Lake. |
| Good Luck | Argentine | Clear Creek. |
| G. P. Wood | Sugar Loaf | Boulder. |
| Grand Central | Central | Do. |
| Grand Exchange | Red Mountain | Ouray. |
| Grand Prize | do | Do. |
| Grand Republic | Sheep Mountain | Gunnison. |
| Grand View | Red Mountain | Ouray. |
| Do | Iron Springs | San Miguel. |
| Do | Pioneer | Dolores. |
| Granite | Bullion | Park. |
| Great Eastern | Red Cliff | Eagle. |
| Great O'Sullivan | Leadville | Lake. |
| Great Republic | Central | Gilpin. |
| Great Western | Holy Cross | Eagle. |
| Green Mountain | Silverton | San Juan. |
| Gregory | Nevada | Gilpin. |
| Grey Copper | Gold Hill | Boulder. |
| Grey Eagle | Hazelton | San Juan. |
| Guadaloupe | Red Mountain | Ouray. |
| Gum Tree | Trail Creek | Clear Creek. |
| Gunnell | Nevada | Gilpin. |
| Gunnison | Leadville | Lake. |
| Greston | Red Mountain | Ouray. |
| Hahn's Peak | Hahn's Peak | Routt. |
| Hard Cash | Iron Springs | San Miguel. |
| Hard Money | Central | Gilpin. |
| Hardscrabble | Hannah Mt | Clear Creek. |
| Harrison | Union | Summit. |
| Harrison Tunnel | Chalk Creek | Chaffee. |
| Haseltine | Russell | Gilpin. |
| Hawkeye | Gold Basin | Gunnison. |
| H. D. Pearsoll | Tin Cup | Do. |
| Heck | California | La Plata. |
| Henriette | Leadville | Lake. |
| Herman | Union | Summit. |
| Hiawatha | Tomichi | Gunnison. |
| Hibernia | Leadville | Lake. |
| Hidden Treasure | Nevada | Gilpin. |
| Do | Central | Boulder. |
| Do | Iron Springs | San Miguel. |
| Highland Chief | Leadville | Lake. |
| Do | Sneffles | Ouray. |
| Horn Silver | Horn Silver Mt | Eagle. |
| Horsefal | Gold Hill | Boulder. |
| Hortense | Bonanza | Saguache. |
| Do | Cottonwood | Chaffee. |
| Hubert | Nevada | Gilpin. |

*List of the mines of the United States producing gold and silver*—Continued.

COLORADO—Continued.

| Name of mine. | District. | County. |
|---|---|---|
| Hudson | Red Mountain | Ouray. |
| Humboldt Consolidated. | Leadville | Lake. |
| Hunkidore | Union | Summit. |
| Illinois | Nevada | Gilpin. |
| Independence | McClellan Mt | Clear Creek. |
| Do | Red Mountain | Ouray. |
| Do | Lake City | Hinsdale. |
| India | Bonanza | Saguache. |
| Inter-Ocean | Sunshine | Boulder. |
| Iridos | California | La Plata. |
| Iron | Galena Mt | Gunnison. |
| Iron Bonnet | Tin Cup | Do. |
| Iron Chest | Chalk Creek | Chaffee. |
| Iron Cup | Tin Cup | Gunnison. |
| Iron Hill | Leadville | Lake. |
| Iron Silver | do | Do. |
| Iroquois | do | Do. |
| I. X. L | Union | Hinsdale. |
| Jacob Straeder | Poverty Gulch | Gunnison. |
| James Henry | Central | Gilpin. |
| Jed | Red Mountain | Ouray. |
| Jennette | Hope | Chaffee. |
| Jennie Lind | Poverty Gulch | Gunnison. |
| Jimmy Mack | Tin Cup | Do. |
| Joe and John | Red Mountain | Ouray. |
| Joe Reynolds | Argentiferous | Clear Creek. |
| John Jay | Central | Boulder. |
| Jones & Co | Iron Springs | San Miguel. |
| Kalamazoo Bonanza. | Eureka | San Juan. |
| Kangaroo | Clear Creek | Chaffee. |
| Kansas | Montgomery | Park. |
| Kate | Silver Cliff | Custer. |
| Keims | Iron Springs | San Miguel. |
| Kent County | Nevada | Gilpin. |
| Keystone | Nevada | Do. |
| Kirkley | Griffith | Clear Creek. |
| Kikionga | Magnolia | Boulder. |
| King Fisher | Red Cliff | Eagle. |
| King of the Ranch | Central | Gilpin. |
| Kohinoor | Argentiferous | Clear Creek. |
| K. P | Mosquito | Park. |
| Lackawana | Silverton | San Juan. |
| La Crosse | Silver City | Clear Creek. |
| La Crosse Burroughs. | Nevada | Gilpin. |
| Lake Shore | Breckenridge | Summit. |
| La Plata | Leadville | Lake. |
| Last Chance | Central | Boulder. |
| Laura | San Miguel | San Miguel. |
| Leadville Consolidated. | Leadville | Lake. |
| Leavenworth | Nevada | Gilpin. |
| Do | Silver Cliff | Custer. |
| Lee Basin | Leadville | Lake. |
| Legal Tender | Tomichi | Gunnison. |
| Lelia Davis | Pioneer | Dolores. |
| Lelon | Breckenridge | Summit. |
| Lilly | Galena | Hinsdale. |
| Lincoln | Griffith | Clear Creek. |
| Linden Castle | Central | Dolores. |
| Little Annie | Summit | Rio Grande. |
| Do | Red Mountain | Ouray. |
| Little Bonanza | Chalk Creek | Chaffee. |
| Little Chicago | Kokomo | Summit. |
| Little Chief | Leadville | Lake. |
| Do | Red Cliff | Eagle. |
| Little Corinne | Leadville | Lake. |
| Little Emma | Democrat Mt | Clear Creek. |
| Do | Rice | Dolores. |
| Little Ellen | Leadville | Lake. |
| Little Elva | Bonanza | Saguache. |
| Little Jennie | do | Do. |
| Little Lake | Hall's Gulch | Park. |
| Little Maud | Red Mountain | Ouray. |
| Little Maggie | Pioneer | Dolores. |
| Little Pittsburg | Leadville | Lake. |
| Little Silver | do | Do. |

| Name of mine. | District. | County. |
|---|---|---|
| Liverpool | Mosquito | Park. |
| Livingston | Chalk Creek | Chaffee. |
| London | Mosquito | Park. |
| Lookout | Iron Springs | San Miguel. |
| Lost Lode | Eureka | San Juan. |
| Long and Derry | Leadville | Lake. |
| Lucky Hesperus | Democrat Mt | Clear Creek. |
| Luzerne | Leadville | Lake. |
| Mackey Burroughs. | Nevada | Gilpin. |
| Madonna | Monarch | Chaffee. |
| Maggie Mitchell | Quartz | Gunnison. |
| Magnolia | Gold Hill | Boulder. |
| Maid of Erin | Leadville | Lake. |
| Manitou | Sawley Gulch | Saguache. |
| Margaret Glennon. | Central | Gilpin. |
| Marion | Leadville | Lake. |
| Mark Twain | Montezuma | Summit. |
| Mars | Bonanza | Saguache. |
| Matchless | Leadville | Lake. |
| Matilda Fletcher. | Democrat Mountain, | Clear Creek. |
| Matt | Sugar Loaf | Boulder. |
| Maud S | Red Mountain | Ouray. |
| Mayflower | Tin Cup | Gunnison. |
| May's Gulch | Hahn's Peak | Routt. |
| McIntosh | Poverty Bar | Do. |
| M. C. R. R | Tin Cup | Gunnison. |
| Mendota | San Miguel | San Miguel. |
| Do | Griffith | Clear Creek. |
| Merrimac | Red Mountain | Ouray. |
| Meyer | Leadville | Lake. |
| Miantonoma | Tin Cup | Gunnison. |
| Michigan | Lake City | Hinsdale. |
| Midnight | Quartz | Gunnison. |
| Mike and Starr | Leadville | Lake. |
| Milwaukee | Sheep Mountain | Gunnison. |
| Mineral Farm | Uncompahgre | Ouray. |
| Mineral Hill | Union | Summit. |
| Do | Red Mountain | Ouray. |
| Mineral Point | Central | Boulder. |
| Mitchner | Gold Hill | Do. |
| Mohawk | Iron Springs | San Miguel. |
| Moline Tunnel | Democrat Mountain. | Clear Creek. |
| Mollie | Chalk Creek | Chaffee. |
| Monarch | Monarch | Do. |
| Do | Red Mountain | Ouray. |
| Mono Queen | do | Do. |
| Montezuma | Ashcroft | Pitkin. |
| Moonlight | Quartz | Gunnison. |
| Moose | Buckskin | Park. |
| Morning Glory | Salina | Boulder. |
| Morning Star | Leadville | Lake. |
| Morris Thomas | Black Hawk | Gilpin. |
| Mount Wilson | San Miguel | San Miguel. |
| Mountain Chief | Gold Hill | Boulder. |
| Mountain Lion | Red Mountain | Ouray. |
| Murphy | Chalk Creek | Chaffee. |
| Murray | Seaton Mountain | Clear Creek. |
| Napoleon | Tin Cup | Gunnison. |
| Do | Gold Hill | Boulder. |
| National | Nevada | Gilpin. |
| National Belle | Red Mountain | Ouray. |
| Nellie | San Miguel | San Miguel. |
| Nettie B. Forest | Sheep Mountain | Summit. |
| Nettie S | Leadville | Lake. |
| Nevada | Iron Springs | San Miguel. |
| New York | Mosquito | Park. |
| New York and Colorado. | Monarch | Chaffee. |
| New Pittsburgh | Leadville | Lake. |
| News Enterprise | Gold Hill | Boulder. |
| Newman | Pioneer | Dolores. |
| Niagra | Central | Boulder. |
| Nimrod | Nevada | Gilpin. |
| North Andover | Sunbeam Mountain. | Saguache. |

*List of the mines of the United States producing gold and silver*—Continued.

COLORADO—Continued.

| Name of mine. | District. | County. |
|---|---|---|
| North Star | Tomichi | Gunnison. |
| Do | Solomon Mountain. | San Juan. |
| North Star No. 1. | Silverton | Do. |
| North Star No. 2. | do | Do. |
| Northern Boy | Chalk Creek | Chaffee. |
| Nova Zembla | Montgomery | Park. |
| Nyanza | Democrat Mountain. | Clear Creek. |
| O. K | Leadville | Lake. |
| Opulent | do | Do. |
| Oro City | do | Do. |
| Orphan Boy | Red Mountain | Ouray. |
| Orphan Girl | Pioneer | Dolores. |
| Oshkosh | Monarch | Chaffee. |
| Ouray Union | Uncompahgre | Ouray. |
| Palmyra | San Miguel | San Miguel. |
| Pandora and Oriental. | do | Do. |
| Paradise | do | Do. |
| Park | Leadville | Lake. |
| Parloe | Pioneer | Dolores. |
| Pay Rock | Republican Mt. | Clear Creek. |
| Peabody | Union | Summit. |
| Pease | Hall's Gulch | Park. |
| Pelican Dives | Republican | Clear Creek. |
| Pelican | Pioneer | Dolores. |
| Perigo | Independence | Gilpin. |
| Pet | Central | Boulder. |
| Philips | Sugar Loaf | Do. |
| Phœnix | Pioneer | Dolores. |
| Pine Shade | Seaton Mountain | Clear Creek. |
| Pine Tree | Montgomery | Park. |
| Pinnacle | Leadville | Lake. |
| Pioneer | Buckskin | Park. |
| Piqua | Union | Summit. |
| Pitkin | Iron Springs | San Miguel. |
| Pleasant View | Central | Gilpin. |
| Polar Star | Galena | Lake. |
| Poorman | Caribou | Boulder. |
| Porcupine | Quartz | Gunnison. |
| Pride of the West | Silverton | San Juan. |
| Printer Boy | Washington Gulch. | Gunnison. |
| Prize Sendenburg | Nevadaville | Gilpin. |
| Prompt Boy | Nevada | Do. |
| Prussian | Gold Hill | Boulder. |
| Puzzle | Pioneer | Dolores. |
| Pyrenees | Nevada | Gilpin. |
| Queen | Saxon Mountain | Clear Creek. |
| Queen Bee | Cottonwood | Chaffee. |
| Rara Avis | Eureka | Gilpin. |
| Rawley | Bonanza | Saguache. |
| Reconstruction | Ten Mile | Summit. |
| Red Elephant | Argentiferous | Clear Creek. |
| Red Lion | Mosquito | Park. |
| Republic | Russell | Gilpin. |
| Revenue | Bonanza | Saguache. |
| Richmond | Gold Hill | Boulder. |
| Rip Van Dam | Central | Do. |
| Robert Emmet | Leadville | Lake. |
| Robert E. Lee | do | Do. |
| Robinson | Red Mountain | Ouray. |
| Robinson Consolidated. | Ten Mile | Summit. |
| Rockford | Tomichi | Gunnison. |
| Roderick Dhu | Nevada | Gilpin. |
| Rodgers | Democrat Mountain. | Clear Creek. |
| Rollins | Rollinsville | Gilpin. |
| Romance | Central | Boulder. |
| Ronville | Red Mountain | Ouray. |
| Rose | Uncompahgre | Do. |
| Rothschild | Tin Cup | Gunnison. |
| Ruby | Leadville | Lake. |
| Ruby King | California | La Plata. |
| Running | Bob Tail Hill | Gilpin. |
| Russia | Montgomery | Park. |
| Sacramento | Cascade | Clear Creek. |
| Sacramento | Montgomery | Park. |
| Sailor Boy | Red Mountain | Ouray. |
| Saint Bernard | Leadville | Lake. |
| Saint Elmo | Ashcroft | Pitkin. |
| Do | Poverty Gulch | Gunnison. |
| Saint Louis | Leadville | Lake. |
| Salem | Red Mountain | Ouray. |
| Salt Lake | Union | Summit. |
| Santa Clara | Pioneer | Dolores. |
| Santa Cruz | Iron Springs | San Miguel. |
| Santa La Sario | Caribou | Boulder. |
| Saint Joe | Union | Clear Creek, |
| San Juan | Iron Springs | San Miguel. |
| Do | Summit | Rio Grande. |
| Saratoga | Central | Gilpin. |
| Saxon | Silverton | San Juan. |
| S. B | Central | Boulder. |
| Scotia | Sherman Mt | Clear Creek. |
| Scranton City | Silverton | San Juan. |
| Seguin | Leadville | Lake. |
| Seven Thirty | Brown Mountain | Clear Creek. |
| Seventy-nine | Union | Summit. |
| Seymour | do | Do. |
| Shamrock | Leadville | Lake. |
| Shields | do | Do. |
| Shivelby | Brown Mountain. | Clear Creek. |
| Sheridan | San Miguel | San Miguel. |
| Sidell | Hall's Gulch | Park. |
| Sidney | Sneffles | Ouray. |
| Silver Age | Red Cliff | Eagle. |
| Silver Bell | Iron Springs | San Miguel. |
| Do | Conundrum | Park. |
| Silver Belle | San Miguel | San Miguel. |
| Silver Coin | Silver Cliff | Custer. |
| Silver Cord | Leadville | Lake. |
| Silver Dust | Mosquito | Park. |
| Silver Glance | Idaho Springs | Clear Creek. |
| Silver King | Cascade | Do. |
| Do | Poverty Gulch | Gunnison. |
| Silver Lake | Silverton | San Juan. |
| Silver Ledge | Kelso Mountain | Clear Creek. |
| Do | Red Mountain | Ouray. |
| Silver Plume | Argentine | Clear Creek. |
| Silverton | Silverton | San Juan. |
| Sierra Nevada | Chalk Creek | Chaffee. |
| Silent Friend | Monarch | Do. |
| Do | Quartz Creek | Gunnison. |
| Slide | Gold Hill | Boulder. |
| Small Hopes | Leadville | Lake. |
| Smuggler | Aspen | Pitkin. |
| Do | Central | Boulder. |
| Smuggler Consolidated. | Leadville | Lake. |
| Smuggler | Mosquito | Park. |
| Do | San Miguel | San Miguel. |
| South Comstock | California | La Plata. |
| South Park | Pioneer | Dolores. |
| Sovereign | Montgomery | Park. |
| Spar | Aspen | Pitkin. |
| Do | Iron Springs | San Miguel. |
| Spint | Red Cliff | Eagle. |
| Staatsburgh | Iron Springs | San Miguel. |
| Standard | Central | Boulder. |
| Star of the West | Lake | Gilpin. |
| Sterling | Republican Mt. | Custer. |
| Stone | Leadville | Lake. |
| Stonewall Jackson. | Sneffles | Ouray. |
| Storm King | Ten Mile | Summit. |
| Straeder | Crested Buttes | Gunnison. |
| Suffolk | Iron Springs | San Miguel. |
| Summit | do | Do. |
| Sunlight | do | Do. |
| Sunnyside | Eureka | San Juan. |
| Sunshine | Red Mountain | Ouray. |
| Susquehanna | Central | Gilpin. |
| Swansea | Pioneer | Dolores. |
| Swiss Boy | Clear Creek | Chaffee. |

*List of mines of the United States producing gold and silver*—Continued.

## COLORADO—Continued.

| Name of mine. | District. | County. | Name of mine. | District. | County. |
|---|---|---|---|---|---|
| Sylph | Idaho Springs | Clear Creek. | Vining | Leadville | Lake. |
| Sylvan Bell | Tin Cup | Gunnison. | Virginius | Sneffles | Ouray. |
| Tam O'Shanter | Ashcroft | Pitkin. | Volunteer | Quartz Creek | Gunnison. |
| Tarry All | Como | Park. | Vulcan | Republican Mt | Clear Creek. |
| Telephone | Brown Mountain | Clear Creek. | Ward | Leadville | Lake. |
| Tellurium | Tin Cup | Gunnison. | Washburn | Sunshine | Boulder. |
| Tenderfoot | Leadville | Lake. | Washington | Union | Summit. |
| Ten Forty | Central | Boulder. | Waterloo | Leadville | Lake. |
| Do | Buckskin | Park. | Waterman | Snake River | Summit. |
| Terrible | Quartz Creek | Gunnison. | Way Up | Quartz Creek | Gunnison. |
| Do | Leadville | Lake. | West Side | Fletcher Mt | Summit. |
| Tidal Wave | Iron Springs | San Miguel. | Weston | Mosquito | Park. |
| Tin Cup | Tin Cup | Gunnison. | Whale | Hall's Gulch | Do. |
| Do | Red Mountain | Ouray. | What Cheer | Iron Springs | San Miguel. |
| Tip Top | Iron Springs | San Miguel. | Wheel of Fortune | Sneffles | Ouray. |
| Tourtellotte | Conundrum | Pitkin. | Wheeler | Buckskin | Park. |
| Toronto | Central | Gilpin. | Wheeling | East Argentine | Clear Creek. |
| Trade Dollar | Leadville | Lake. | White Cloud | Russell | Gilpin. |
| Treasure Trove | Red Mountain | Ouray. | White Quail | Ten-Mile | Summit. |
| Tressic, C | Chalk Creek | Chaffee. | Whopper | Poverty Gulch | Gunnison. |
| Tropic | Seaton Mountain | Clear Creek. | Williams | Lake | Gilpin. |
| Trout Lake | Trout Lake | San Miguel. | William Germain | Sugar Loaf | Boulder. |
| Turkois | Red Mountain | Ouray. | Windy Point | Tin Cup | Gunnison. |
| Turman | Mosquito | Park. | Windsor | Empire | Clear Creek. |
| Twin Lakes | Clear Creek | Chaffee. | Do | Silverton | San Juan. |
| Ulay | Galena | Hinsdale. | Winfred | Iron Springs | San Miguel. |
| Uncle Sam |  | San Juan. | W. L. Stevens | Pioneer | Dolores. |
| Union | Uncompahgre | Ouray. | Wolf Tone and Agassiz. | Leadville | Lake. |
| Union Tunnel | Bob Tail Hill | Gilpin. | Wolverine | Democrat Mt | Clear Creek. |
| United Gregory | Black Hawk | Do. | Wyandotte | Buckskin | Park. |
| U. P | Mosquito | Park. | Do | Russell | Gilpin. |
| U. P. R | Fall River | Clear Creek. | Yankee Doodle | Leadville | Lake. |
| Ute | Galena | Hinsdale. | Do | Kerber Creek | Saguache. |
| Van Buren | Gold Hill | Boulder. | Yankee Girl | Red Mt | Ouray. |
| Van Clure | do | Do. | Yellow Jacket | Tin Cup | Gunnison. |
| Vanchus | Sugar Loaf | Do. | Do | Pioneer | Dolores. |
| Venango | Ruby | Gunnison. | Yellow Pine | Sugar Loaf | Boulder. |
| Venture | Leadville | Lake. | Yellow Rose | Sneffles | Ouray. |
| Vermont | Sherman | Hinsdale. | Young American | Leadville | Lake. |
| Veto | Seaton Mountain | Clear Creek. | Ypsilanti | Hall's Gulch | Park. |
| Victoria | Gold Hill | Boulder. |  |  |  |

## DAKOTA.

| Name of mine. | District. | County. | Name of mine. | District. | County. |
|---|---|---|---|---|---|
| Bengal Tiger | Tigerville | Pennington. | High Lode Extension. | Carbonate Camp | Lawrence. |
| Caledonia | Whitewood | Lawrence. | Highland | Galena | Do. |
| Chipman Bar | Rochford | Pennington. | Homestake | Whitewood | Do. |
| Deadwood Hydraulic. | Deadwood Gulch | Lawrence. | Jenny Lind | Rochford | Pennington. |
| Deadwood Terra. | Whitewood | Do. | Minnesota | do | Do. |
| Estrella del Norte | Rochford | Pennington. | Noble Grand | Two-bit Gulch | Lawrence. |
| Father de Smet | Whitewood | Lawrence. | Oro Fino | Galena | Do. |
| Garfield Mining Co. | Harney | Pennington. | Penobscot | Custer | Custer. |
| Goleonda | Carbonate Camp | Lawrence. | Portland Consolidated. | Bald Mountain | Lawrence. |
| Gold Finch | do | Do. | Saint Elmo | Palmer Gulch | Pennington. |
| Golden Summit | Palmer Gulch | Pennington. | Silver King | Rockford | Do. |
| Grand Junction | Custer | Custer. | Sitting Bull | Galena | Lawrence. |
| Great West | Rochford | Pennington. | Stand-by | Rochford | Pennington. |
| Grizzly Bear | Palmer Gulch | Do. | Uncle Sam | Galena | Lawrence. |
| Harney H'draulic | Haywood | Custer. |  |  |  |

## GEORGIA.

| Name of mine. | District. | County. | Name of mine. | District. | County. |
|---|---|---|---|---|---|
| Barlow |  | Lumpkin. | Dr. Charles |  | Forsyth. |
| Bast |  | Do. | Earl Percy |  | Gwinnett. |
| Blake |  | White. | Findley |  | Lumpkin. |
| Calhoun |  | Lumpkin. | Fish Traps |  | Do. |
| Chestatee |  | Do. | Franklin |  | Cherokee. |
| Chicago & Georgia. |  | Do. | Garnet |  | Lumpkin. |
|  |  |  | J. R. Dean |  | White. |
| Clopton |  | Cherokee. | Jarrett |  | Do. |
| Columbia |  | Lumpkin. | Joy |  | Lumpkin. |

*List of the mines of the United States producing gold and silver*—Continued.

### GEORGIA—Continued.

| Name of mine. | District. | County. | Name of mine. | District. | County. |
|---|---|---|---|---|---|
| Kempbell |  | Cherokee. | Nacooche |  | White. |
| Kinmori |  | Dawson. | Pigeon Roost |  | Lumpkin. |
| Little Daisy |  | Lumpkin. | Price |  | Hall. |
| Loud |  | White. | Singleton |  | Lumpkin. |
| McDonald |  | Cherokee. |  |  |  |

### IDAHO.

| Name of mine. | District. | County. | Name of mine. | District. | County. |
|---|---|---|---|---|---|
| Ada Elmore | Rocky Bar | Alturas. | Lock Kee | Idaho City | Boise. |
| Alturas | do | Do. | Lucky Boy | Sawtooth | Alturas. |
| Atlanta | Atlanta | Do. | Mayflower | Bellevue | Do. |
| Badger | Warm Springs | Do. | Meacham Bar | Meacham Bar | Ada. |
| Baltimore | do | Do. | Minnie Moore | Bellevue | Alturas. |
| Banner | Banner | Boise. | Miller | War Eagle | Owhyee. |
| Belmont | Heath | Washington. | Minnesota | do | Do. |
| Big Camas | Bellevue | Alturas. | Monarch | Atlanta | Alturas. |
| Big Lode | Atlanta | Do. | Montana | Bellevue | Do. |
| Billy Burker | Idaho City | Boise. | Do | Yankee Fork | Custer. |
| Black Horse | Ketchum | Alturas. | Mountain King | Sawtooth | Alturas. |
| Black Sack | Florida Mt | Owyhee. | Mountain View | Bellevue | Do. |
| Bob Ingersoll | Bellevue | Alturas. | Mountain Queen | Ketchum | Do. |
| Bonaparte | Rocky Bar | Do. | Muldoon | Little Wood River. | Do. |
| Boulder | Warm Springs | Do. |  |  |  |
| Buffalo | Atlanta | Do. | Narrow Gauge | Hailey | Do. |
| Bull of the Woods | Bayhorse | Custer. | Noonday | Ketchum | Do. |
| Bullion | Bullion | Alturas. | North Star | do | Do. |
| Bullwhacker | do | Do. | O. K | Bullion | Do. |
| Buzzini | Idaho City | Boise. | Ontario | Warm Springs | Do. |
| Capital | Quartzburg | Do. | Panamint | Banner | Boise. |
| Chamberlin | Eagle River | Oneida. | Paradise | Yankee Fork | Custer. |
| Charles Dickens | Yankee Fork | Custer. | Parker | Warm Springs | Alturas. |
| Cinnabar | Bayhorse | Do. | Perseverance | Flint | Owyhee. |
| Clements | Cariboo | Oneida. | Pilgrim | Sawtooth | Alturas. |
| Clipper | Bellevue | Alturas. | Pilot | Yankee Fork | Custer. |
| Comstock | Sawtooth | Do | Placers | Cœur d'Aline | Shoshone. |
| Crown Point | Banner | Boise. | Point Lookout | Bullion | Alturas. |
| Dan O'Connell | Yankee Fork | Custer. | Pommery | Atlanta | Do. |
| David McNutt | Moose Creek | Lemhi. | Post Boy | Bayhorse | Custer. |
| Davitt | Bullion | Alturas. | Queen of the Hills | Bullion | Alturas. |
| Elizabeth | War Eagle | Owyhee. | Ramshorn | Bayhorse | Custer. |
| Elkhorn | Warm Springs | Alturas. | Red Elephant | Bullion | Alturas. |
| Empire State | Florida Mt | Owyhee. | Rising Star | Flint | Owyhee. |
| Esmeralda | Gibbonsville | Lemhi. | Robert Emmett | Bullion | Alturas. |
| Etna | Dahlonega | Do. | Seventy-nine | Reynold's Creek | Owyhee. |
| Eureka | Bullion | Alturas. | Silver King | Sawtooth | Alturas. |
| Excelsior | Bayhorse | Custer. | Silver Star | do | Do. |
| General Custer | Yankee Fork | Do. | Silver Wing | Bayhorse | Custer. |
| Gold Hill | Quartzburg | Boise. | Solace | Sawtooth | Alturas. |
| Golden Circle | Gibbonsville | Lemhi. | South Side | Flint | Owyhee. |
| Gray Silver | Hailey | Alturas. | Stony Hill | Silver City | Do. |
| H. S. Cheasbro | Reynold's Creek | Owyhee. | Tramp | Washington | Idaho. |
| Humbug | Bellevue | Alturas. | Unknown | Yankee Fork | Custer. |
| Idaho | Rocky Bar | Do. | Utah Boy | Bayhorse | Do. |
| Idahoan | Bullion | Do. | Vienna | Sawtooth | Alturas. |
| Idlewild | War Eagle | Owyhee. | Vishnu | Rocky Bar | Do. |
| Independence | Warm Springs | Alturas. | War Eagle | War Eagle Mt | Owyhee. |
| Iowa | Quartzburg | Boise. | Washington | Bullion | Alturas. |
| Irwine | Warm Springs | Alturas. | Webster | War Eagle Mt | Owyhee. |
| Japan | Hailey | Do. | W. H. Edwards & Co. | Eagle Rock | Oneida. |
| Jay Gould | Bullion | Do. |  |  |  |
| Jessie Benton | Atlanta | Do. | Wm. Edwards | Dahlonega | Lemhi. |
| Joe Garrison | Bellevue | Do. | Whiskey | War Eagle Mt | Owyhee. |
| Juniata | Warm Springs | Do. | Wire Silver | Sawtooth | Alturas. |
| Kentuck | Mineral Hill | Lemhi. | Wolverine | Banner | Boise. |
| Knott | Washington | Idaho. | Yellow Jacket | Quartzburg | Do. |
| Leviathan | Reynold's Creek | Owyhee. |  |  |  |

### MONTANA.

| Name of mine. | District. | County. | Name of mine. | District. | County. |
|---|---|---|---|---|---|
| Albion | Ten Mile | Lewis and Clarke. | American Flag | Ten Mile | Lewis and Clarke. |
| Algonquin | Flint | Deer Lodge. | Anaconda | Summit Valley | Silver Bow. |
| Alice | Summit Valley | Silver Bow. | Bear Gulch | Flint | Gallatin. |
| Alta | Wicks | Jefferson. | Bell | Summit | Silver Bow. |

*List of the mines of the United States producing gold and silver*—Continued.

## MONTANA—Continued.

| Name of mine. | District. | County. |
|---|---|---|
| Belle of Butte | Summit | Silver Bow. |
| Black Warrior | Clark's Fork | Gallatin. |
| Blue Bird | Bald Butte | Lewis and Clarke. |
| Bonanza | Quartz | Beaver Head. |
| Boston and Montana. | do | Do. |
| Burlington | Summit | Silver Bow. |
| Cable | Cable Mountain | Deer Lodge. |
| Cameron | Georgetown | Beaver Head. |
| Chipmunk | Quartz | Do. |
| Clark's Fraction | Summit Valley | Silver Bow. |
| Clear Grit | do | Do. |
| Cleopatra | Glendale | Beaver-Head. |
| Clendenin | Barker | Meagher. |
| Collar | Maiden | Do. |
| Colusa | Summit Valley | Silver Bow. |
| Comet | Wicks | Jefferson. |
| Dakota | Bannack | Beaver Head. |
| Diamond Flume | Confederate Gulch. | Meagher. |
| Drum Lumon | Bald Butte | Lewis and Clarke. |
| Gagnor | Summit | Silver Bow. |
| Gloster | Bald Butte | Lewis and Clarke. |
| Grubstake | Ten Mile | Do. |
| Granite | Flint Creek | Deer Lodge. |
| Great Republic | Clark's | Gallatin. |
| Greely | Quartz | Beaver Head. |
| Gregory | Gregory | Jefferson. |
| Grey Rock | Summit | Silver Bow. |
| Hecla Consolidated. | Glendale | Beaver Head. |
| Hickey | Bald Butte | Lewis and Clarke. |
| Homestake | Ten Mile | Do. |
| Hope | Flint | Deer Lodge. |
| Josephine | Summit | Silver Bow. |
| La Plata | do | Do. |
| Last Chance | Flint | Deer Lodge. |
| Lexington | Summit Valley | Silver Bow. |
| Liquidator | Summit | Do. |
| Little Giant | | Jefferson. |
| Lone Pine | Quartz | Beaver-Head. |
| Magna Charter | Summit | Silver Bow. |
| Montana | Maiden | Meagher. |
| Montana Belle | Montana | Do. |
| Montana Boy | Summit | Silver Bow. |
| Montana Copper | do | Do. |
| Moulton | do | Do. |
| Mount Moriah | do | Do. |
| New Departure | Blue Wing | Beaver Head. |
| North Pacific | Maiden | Meagher. |
| Ora Cache | Maiden | Do. |
| Orevice | Orevice Gulch | Gallatin. |
| Original | Summit | Silver Bow. |
| Parrott | Summit | Silver Bow. |
| Placers | Basin | Lewis and Clarke. |
| Do | Last Chance | Do. |
| Do | Dry | Do. |
| Do | Lower Bar | Do. |
| Do | Monitor | Do. |
| Do | Try Again | Do. |
| Do | Ten Mile | Do. |
| Do | Virginia Creek | Do. |
| Do | Missouri River | Do. |
| Do | Rattlesnake Gulch. | Beaver Head. |
| Do | Fish Creek | Do. |
| Do | Hiland | Do. |
| Do | Moose Creek | Do. |
| Do | Rochester | Do. |
| Do | Pioneer | Deer Lodge. |
| Do | Bear Gulch | Do. |
| Do | Elk | Do. |
| Do | Tucher | Do. |
| Do | Harris Gulch | Madison. |
| Do | California Gulch | Do. |
| Do | Bivens Gulch | Do. |
| Do | Wisconsin Gulch | Do. |
| Do | Alden Gulch | Do. |
| Do | Grewell's Bar | Meagher. |
| Do | Thompson Gulch | Do. |
| Do | El Dorado Bar | Do. |
| Do | Oregon Park | Do. |
| Do | Cooper Gulch | Do. |
| Do | Confederate Gulch. | Do. |
| Do | Cave Gulch | Do. |
| Do | Avalanche Gulch | Do. |
| Do | Three-Mile Gulch. | Missoula. |
| Do | Nine Gulch | Do. |
| Do | Cedar Creek Gulch. | Do. |
| Poser | Summit | Silver Bow. |
| Pyrenese | | Deer Lodge. |
| R. S. Hale | Tucker Gulch | Lewis and Clarke. |
| Sagmore | Summit | Silver Bow. |
| Saint Lawrence | do | Do. |
| Shonbar | do | Do. |
| Silver | Glendale | Beaver Head. |
| South Pacific | Ten Mile | Lewis and Clarke. |
| Star | Maiden | Meagher. |
| Star West | Summit | Silver Bow. |
| Trout | Flint | Deer Lodge. |
| Whipporwill | Ten Mile | Lewis and Clarke. |
| White Pine | Pony | Madison. |
| Willow Creek | do | Do. |

## NEVADA.

| | | |
|---|---|---|
| Albion | Eureka | Eureka. |
| Alexandria | do | Do. |
| Altoona | do | Do. |
| Andes | Comstock | Storey. |
| Antelope | Eureka | Eureka. |
| Argenta | Tuscarora | Elko. |
| Auburn | Dun Glen' | Humboldt. |
| Austin | Mineral Hill | Eureka. |
| Bald Eagle | Eureka | Do. |
| Baltimore Consolidated. | Virginia City | Storey. |
| Banner | Safford | Eureka. |
| Bay State | White Pine | White Pine. |
| Belcher | Comstock | Storey. |
| Belle Isle | Tuscarora | Elko. |
| Belmont | Belmont | Nye. |
| Big Gun | Silver City | Lyon. |
| Blue Bell | White Pine | White Pine. |
| Blue Point | | Nye. |
| Bowman | Eureka | Eureka. |
| Breech-loader | Taylor | White Pine. |
| Breen | | Lander. |
| Brown | Eureka | Eureka. |
| Buckeye | Silver City | Lyon. |
| Bullion | Paradise | Humboldt. |
| Bullionville | Bristol | Lincoln. |
| Butler | Eureka | Eureka. |
| Centennial | Esmeralda | Esmeralda. |
| Challenge | Comstock | Storey. |
| Charles H. Eyer | Eureka | Eureka. |
| Chollar | Comstock | Storey. |
| Christie | Mineral Hill | Eureka. |

*List of the mines of the United States producing gold and silver*—Continued.

NEVADA—Continued.

| Name of mine. | District. | County. |
|---|---|---|
| Colorado | Eureka | Eureka. |
| Columbus Consolidated. | Columbus | Esmeralda. |
| Confidence | Comstock | Storey. |
| Consolidated Buckeye. | Grand Hope | Elko. |
| Contract | Eureka | Eureka. |
| Cook and Gray | Silver City | Lyon. |
| Cortez | Esmeralda | Esmeralda. |
| Cronin | Pennsylvania | Lincoln. |
| Crown Point | Comstock | Storey. |
| Cosmopolitan | Silver City | Lyon. |
| Day | Highland | Lincoln. |
| Dead Broke | Eureka | Eureka. |
| Death Valley | Lida | Do. |
| Delaware | Eureka | Do. |
| Doran | Columbus | Esmeralda. |
| Downie | Downierville | Nye. |
| Dugout | Eureka | Eureka. |
| Edward Reily | | Elko. |
| El Dorado | Eureka | Eureka. |
| Elna | Esmeralda | Esmeralda. |
| Emerson | Belmont | Nye. |
| Enterprise | Columbus | Esmeralda. |
| Do | Diamond | Eureka. |
| Equitable | Desert | Churchill. |
| Eureka Consolidated. | Eureka | Eureka. |
| Eureka Tunnel | do | Do. |
| Excelsior | do | Do. |
| Exchequer | White Pine | White Pine. |
| Fairplay | Pinto | Eureka. |
| Fair Play | White Pine | White Pine. |
| Fandi | Eureka | Eureka. |
| Flagstaff | Pennsylvania | Lincoln. |
| Flora Temple | Silver City | Lyon. |
| Floral | Pioce | Lincoln. |
| Fort Wayne | White Pine | White Pine. |
| Garrison | Beowawe | Eureka. |
| Geddes and Bertraud. | Eureka | Do. |
| Gila | Reveille | Nye. |
| Gold Hill | Bernice | Churchill. |
| Golden Crown | do | Do. |
| Golden Era | Good Hope | Elko. |
| Gore | Taylor | White Pine. |
| Grace Darling | Schroeder | Eureka. |
| Grand Prize | Tuscarora | Elko. |
| Grant | Eureka | Eureka. |
| Great Eastern | | Lander. |
| Do | Columbus | Esmeralda. |
| Hamburg | Eureka | Eureka. |
| Haskins | Beowawe | Do. |
| Herculean | Eureka | Do. |
| Hidden Ruby | Bernice | Churchill. |
| Holmes | Columbus | Esmeralda. |
| Humboldt Queen. | Cedar | Humboldt. |
| Idaho | Eureka | Eureka. |
| Imperial | Desert | Churchill. |
| Do | Comstock | Storey. |
| Independence | Tuscarora | Elko. |
| Iowa | Willow Creek | Humboldt. |
| Irish Ambassador | | Eureka. |
| Jackson | Eureka | Do. |
| Jefferson | | Nye. |
| J. M. Douglass | | Lyon. |
| Kentuck | Eureka | Eureka. |
| Do | Gold Hill | Storey. |
| Kingfisher | Highland | Lincoln. |
| K. K | Eureka | Eureka. |
| La Salle | Reveille | Nye. |
| Lady Bryan | Comstock | Storey. |
| Lander | Reese River | Lander. |
| Lang Syne | Dun Glen | Humboldt. |
| Lewis Consolidated. | Esmeralda | Esmeralda. |
| Little Giant | Silver City | Lyon. |
| L. J | | Lincoln. |
| London | | Lander. |
| Lucky Hill | Columbus | Esmeralda. |
| Magnet | Eureka | Eureka. |
| Maid Queen | Beowawe | Do. |
| Manhattan | Reese River | Lander. |
| Martin White | Ward | Storey. |
| Matamoras | Eureka | Eureka. |
| McCuen | do | Do. |
| Meadow Valley | | Lincoln. |
| Members | Eureka | Eureka. |
| Mendha | Highland | Lincoln. |
| Merced | | Lander. |
| Mexican | Comstock | Storey. |
| Midas | Silver City | Lyon. |
| Monarch | Safford | Eureka. |
| Monitor | Taylor | White Pine. |
| Monte Christo | Comstock | Storey. |
| Morey | Morey | Nye. |
| Morning Star | Eldorado Cañon | Lincoln. |
| Do | Esmeralda | Esmeralda. |
| Mount Bullion | Silver City | Lyon. |
| Mount Coey | Esmeralda | Esmeralda. |
| Mount Como | Palmyra | Lyon. |
| Mount Diablo | Columbus | Esmeralda. |
| Navajo | Tuscarora | Elko. |
| Nellie | Santa Fé | Esmeralda. |
| New Battle Mountain. | | Lander. |
| New Esmeralda | Esmeralda | Esmeralda. |
| North America | Silver City | Lyon. |
| North Belle Isle | Tuscarora | Elko. |
| North Giant | Mineral Hill | Eureka. |
| North Star | Esmeralda | Esmeralda. |
| Do | Safford | Eureka. |
| Northern Belle | Columbus | Elko. |
| Oneida and Belmont. | Eureka | Eureka. |
| Onondaga | Safford | Do. |
| Ophir | Comstock | Storey. |
| Oro | Cherry Creek | White Pine. |
| Orpheus | Silver Glance | Do. |
| Osceola | Osceola | Do. |
| P and P | Tuscarora | Elko. |
| Paradise | Paradise | Humboldt. |
| Patience | Tuscarora | Elko. |
| Patriot | | Lander. |
| Paul Pry | Eureka | Eureka. |
| Paxton | Reese River | Lander. |
| Paymaster | White Pine | White Pine. |
| Phenix | Eureka | Eureka. |
| Pioneer | Silver City | Lyon. |
| Plymouth | | Lander. |
| Pontiac | Esmeralda | Esmeralda. |
| Potosi | Comstock | Storey. |
| Prospect Mountain. | Eureka | Eureka. |
| Prussian | | Nye. |
| Queen Elizabeth | Reveille | Do. |
| Quincy | Esmeralda | Esmeralda. |
| Regent | Silver City | Lyon. |
| Republic | Eureka | Eureka. |
| Rescue | White Pine | White Pine. |
| Richmond Consolidated. | Eureka | Eureka. |
| Richmond of Nevada. | do | Do. |
| Ross | | |
| Ruby and Dunderberg. | Eureka | Eureka. |
| San Francisco Tunnel. | | Lander. |
| San José | Eureka | Eureka. |
| Santiago | Silver City | Lyon. |
| Savage | Comstock | Storey. |
| Schlomberg | Silver City | Lyon. |
| Self-cocker | Taylor | White Pine. |
| Seventy-seven | Belmont | Nye. |
| Sewank | Esmeralda | Esmeralda. |
| Silver City | Silver City | Lyon. |
| Silver Connor | Eureka | Eureka. |
| Silver Fleece | Beowawe | Do. |
| Silver Lick | Eureka | Do. |

*List of the mines of the United States producing gold and silver*—Continued.

NEVADA—Continued.

| Name of mine. | District. | County. | Name of mine. | District. | County. |
|---|---|---|---|---|---|
| Silver Lining | Esmeralda | Esmeralda. | Twin River | Twin River | Nye. |
| Silver Peak | do | Do. | Two G | Tybo | Do. |
| Silver Point | | Nye. | Tybo Consolidated. | do | Do. |
| Silver Reef | Mineral Hill | Eureka. | | | |
| Silver Ridge | Bernice | Churchill. | Umatilla | Silver City | Lyon. |
| Silver Sides | Beowawe | Eureka. | Union Consolidated. | Comstock | Storey. |
| Silver Slide | | Lander. | | | |
| Silver Stone | Eureka | Eureka. | Vande | Indian | Humboldt. |
| Silver Ward | Willow Creek | Humboldt. | Vegas | Eureka | Eureka. |
| Silver Wedge | | Lander. | Ventura | Beowawe | Do. |
| Silver West | Willow Creek | Eureka. | Vivian | Silver City | Lyon. |
| Silverado | Pinto | Do. | Wheeler | Wilson | Esmeralda. |
| Smoky Hill | White Pine | White Pine. | Wild Goose | Paradise | Humboldt. |
| South Western | | Lincoln. | Do | Bernice | Churchill. |
| Southern | White River | Do. | Williams | Eureka | Eureka. |
| Spencer | Mineral Hill | Eureka. | William Penn | Silver City | Lyon. |
| Stafford | White Pine | White Pine. | Wilson | Wilson | Esmeralda. |
| Star | do | Do. | Woodchopper | Eureka | Eureka. |
| Sunrise | Santa Fé | Esmeralda. | Yankee Blade | Yankee | Lander. |
| Do | Taylor | White Pine. | Yankee Doodle | Schroeder | Eureka. |
| Sunset | Eureka | Eureka. | Yellow Jacket | Comstock | Storey. |
| Techatticup | Pennsylvania | Lincoln. | Do | Gold Hill | Do. |
| Tip Top | Santa Fé | Esmeralda. | Do | Santa Fé | Esmeralda. |
| Tribute | | Lander. | Zanoli | Safford | Eureka. |

NEW MEXICO.

| | | | | | |
|---|---|---|---|---|---|
| Alpha and Omega | Pinos Altos | Grant. | Hornett | Eureka | Grant. |
| American | Eureka | Do. | Howard | do | Do. |
| American Flag | Polomas | Socorro. | Iron King | Kingston | Do. |
| Apache | Lake Valley | Doña Aña. | Do | Organ Mountain. | Doña Aña. |
| Arthur Lee | Cow Springs | Grant. | Iron Mask | Magdalena | Socorro. |
| Atlantic | Pinos Altos | Do. | Illinois | Kingston | Grant. |
| Aztec | Los Cerrillos | Santa Fé. | Ivanhoe | Ivanhoe | Do. |
| Black Hawk | Bullard's Peak | Grant. | Jay Gould | Organ Mountain. | Doña Aña. |
| Black Quartz | Organ Mountain. | Doña Aña. | Johnny Bull | San Simon | Grant. |
| Bob Tail | Hillsborough | Do. | Juanita | Magdalena | Socorro. |
| Bonanza | Organ Mountain. | Do. | Katydid | Pecos | Santa Fé. |
| Do | Los Cerrillos | Santa Fé. | Kelley | Magdalena | Socorro. |
| Bonanza No. 3 | do | Do. | King | Eureka | Grant. |
| Boston | Paschal | Grant. | Lady Franklin | Kingston | Do. |
| Brilliant | Kingston | Do. | Lady Hopkins | Organ Mountain. | Doña Aña. |
| Buffum | Apache | Socorro. | Last Chance | Pyramid | Grant. |
| Bullion | Kingston | Grant. | Little Buck | Organ Mountain. | Doña Aña. |
| Cabinet | Socorro | Socorro. | Little Mac | White Oaks | Lincoln. |
| California Group | Bald Mountain | Grant. | Little Maud | Organ Mountain. | Doña Aña. |
| Carlisle | Steeple Rock | Do. | Lucky | Los Cerrillos | Santa Fé. |
| Carnero | Pueblo | Socorro. | Lulu May | Organ Mountain. | Doña Aña. |
| Cash Entry | Los Cerrillos | Santa Fé. | Maud S | Hanover Gulch | Grant. |
| Champion No. 1 | Picuris | Taos. | Marshall Bonanza | Los Cerrillos | Santa Fé. |
| Champion No. 2 | do | Do. | Mayflower | Ivanhoe | Grant. |
| Chance | Victoria | Grant. | McGregor | Georgetown | Do. |
| Cincinnati | Hermanes | Do. | Memphis | Organ Mountain. | Doña Aña. |
| Clyde | Ivanhoe | Do. | Merritt | Socorro | Socorro. |
| Colossal | Apache | Socorro. | Merrimac | Organ Mountain. | Doña Aña. |
| Commercial | Georgetown | Grant. | Missouri | Picuris | Taos. |
| Cooney | Mogollon | Socorro. | Mitchell | Steeple Rock | Grant. |
| Copper Duke | Organ Mountain | Doña Aña. | Monaska | Kingston | Do. |
| Coppervine | Picuris | Taos. | Mountain Chief | Organ Mountain. | Doña Aña. |
| Dantona | Jarilla | Doña Aña. | Montezuma | Cook's Peak | Grant. |
| Davenport Placers. | New Placers | Santa Fé. | Morning Star | Socorro | Socorro. |
| | | | Mother Lode | Telegraph | Grant. |
| De Soto | Picuris | Taos. | Naiad Queen | Georgetown | Do. |
| Eureka Central | Eureka | Grant. | Norman | Steeple Rock | Do. |
| Florence | Georgetown | Do. | North Homestake | White Oaks | Lincoln. |
| Frazer & Co | Rio Hondo | Taos. | Nugget | Steeple Rock | Grant. |
| Gibson | Organ Mountain. | Doña Aña. | Old Man | Bear Mountain | Do. |
| Girard | do | Do. | Pacific No. 2 | Pinos Altos | Do. |
| Gold Note | Steeple Rock | Grant. | Pilgrim | Steeple Rock | Do. |
| Golden King | Hillsborough | Doña Aña. | Pittsburg | Paschal | Do. |
| Good Hope | Telegraph | Grant. | Polomas Chief | Polomas | Socorro. |
| Graphic | Cook's Peak | Do. | Rain in the Face | Steeple Rock | Grant. |
| Great Western | Los Cerrillos | Santa Fé. | Refugia | Jarilla | Doña Aña. |
| Guiterez | Magdalena | Socorro. | Reserve | Socorro | Socorro. |
| Hardscrabble | do | Do. | Rita | White Oaks | Lincoln. |
| Hillsborough | Kingston | Grant. | Rio Grande | Organ Mountain. | Doña Aña. |
| Horn Silver | Bullard's Peak | Do. | Rockford | Nogal | Lincoln. |

*List of the mines of the United States producing gold and silver*—Continued.

## NEW MEXICO—Continued.

| Name of mine. | District. | County. | Name of mine. | District. | County. |
|---|---|---|---|---|---|
| Royal Purple | Picuris | Taos. | South Homestake. | White Oaks | Lincoln. |
| Ruby | do | Do. | | | |
| Saint Elmo | Organ Mountain. | Doña Aña. | Stevenson | Organ Mountain. | Doña Aña. |
| Saint Louis | Paschal | Grant. | Sumner | Bald Mountain | Grant. |
| Satisfaction | Georgetown | Do. | Superior | Kingston | Do. |
| Seventy-six | Silver City | Do. | Do | Shakspeare | Do. |
| Sherman | do | Do. | Tecumseh | Telegraph | Do. |
| Shoo Fly | Organ Mountain. | Doña Aña. | Thicket | Silver City | Do. |
| Short Cut | do | Do. | Torrence | Socorro | Socorro. |
| Sierra Bella | Lake Valley | Do. | Toughnut | Organ Mountain. | Doña Aña. |
| Sierra Grande | do | Do. | Tuerto Placers | New Placers | Santa Fé. |
| Sierra Plata | do | Do. | Turk | Steeple Rock | Grant. |
| Silver Crown | Hanover Gulch | Grant. | Vera Cruz | Nogal | Lincoln. |
| Silver Gem | Organ Mountain. | Doña Aña. | Victoria | Virginia | Grant. |
| Silver King | Bullard's Peak | Grant. | Viola | Pyramid | Do. |
| Silver Mountain | Apache | Lincoln. | Do | Cedar Grove | Do. |
| Solitaire | Kingston | Grant. | Voltaire | Bald Mountain | Do. |
| Do | White Oaks | Lincoln. | | | |

## NORTH CAROLINA.

| Name of mine. | District. | County. | Name of mine. | District. | County. |
|---|---|---|---|---|---|
| Arlington Guarantee. | | Mecklenburgh. | Hoover | | Randolph. |
| | | | J. C. Mills | | Burke. |
| Baltimore and North Carolina. | | Do. | Johnson | | Mecklenburgh. |
| Bonnie Doon | | Union. | Jones | | Randolph. |
| Bright Light | | Do. | King Mountain | | Gaston. |
| Burns | | Moore. | Labor | | Davidson. |
| Cagle | | Do. | North State | | Guilford. |
| Capps | | Mecklenburgh. | Phœnix | | Cabarrus. |
| | | | Plantue | | Do. |
| Carolina Queen | | Burke. | Red Spring | | Polk. |
| Clegg | | Moore. | Rocky River | | Cabarrus. |
| Coggins | | Montgomery | Rowan | | Rowan. |
| Conrad Hill | | Davidson. | Rudisil | | Mecklenburgh. |
| Crowell | | Stanly. | | | |
| Designolle | | Mecklenburgh. | Saint Catharine | | Catawba. |
| | | | Shuford | | Mecklenburgh. |
| Double Branch | | Polk. | | | |
| Dunn Mountain | | Rowan. | Silver Valley | | Davidson. |
| Gold Hill | | Do. | Tucker | | Cabarrus. |
| Hancock | | McDowell. | Z. Russel | | Montgomery |
| Herring | | Randolph. | | | |

## OREGON.

| Name of mine. | District. | County. | Name of mine. | District. | County. |
|---|---|---|---|---|---|
| Althouse | Althouse | Josephine. | Marysville. | John Day | Grant. |
| Big Slide | do | Do. | Odell & Gardner. | Granite | Do. |
| Blanco Beach | | Curry. | Olive Creek | Olive Creek | Do. |
| Bybee & Newman | Waldo | Josephine. | Ophir Beach | | Curry. |
| Elk Creek | John Day | Grant. | Placers | Rogue River | Do. |
| Eucre Beach | Eucre Creek | Curry. | Do | Sixes River | Do. |
| Galice | Galice Creek | Josephine. | Simmons & Ennis | Waldo | Josephine. |
| Gold Beach | | Curry. | Skeeler & Walker | do | Do. |
| Grave | Grave Creek | Josephine. | Waldo Hydraulic | do | Do. |
| Humboldt | John Day | Grant. | Wide West | Dixie Creek | Grant. |
| Johnson & Klapp | Granite | Do. | Williams | Waldo | Josephine. |
| Kerby | Waldo | Josephine. | Wolfinger | John Day | Grant. |
| Keystone | Dixie Creek | Grant. | | | |

## SOUTH CAROLINA.

| Name of mine. | District. | County. | Name of mine. | District. | County. |
|---|---|---|---|---|---|
| Brewer | | Chesterfield. | Posy Hill | | Union. |
| Haile | | Lancaster. | Thompson | | Do. |
| Magnolia | | York. | West | | Do. |

*List of the mines of the United States producing gold and silver*—Continued.

## UTAH.

| Name of mine. | District. | County. |
|---|---|---|
| Aladdin | Bingham | Salt Lake. |
| Albino | do | Do. |
| American Eagle | Tintic | Juab. |
| Apex | Mintan | Summit. |
| Ashton | Bingham | Salt Lake. |
| Barbee & Walker | Harrisburg | Washington. |
| Beck | Tintic | Juab. |
| Bluebird | Beaver Lake | Beaver. |
| Boston | Star | Do. |
| Brooklyn | Bingham | Salt Lake. |
| Buckeye | Harrisburg | Washington. |
| Bullion | Tintic | Juab. |
| Cactus | Copper Gulch | Beaver. |
| Carbonate | Bradshaw | Do. |
| Carissa | Tintic | Juab. |
| Carry Lode | Bradshaw | Beaver. |
| Cave | do | Do. |
| Champion | Tintic | Juab. |
| Chloride Gem | Clifton | Tooele. |
| Christy | Harrisburg | Washington. |
| City Rock | Little Cottonwood. | Salt Lake. |
| Comet | Copper Gulch | Beaver. |
| Copper-belt | Ohio | Pi Ute. |
| Cornucopia | Tintic | Juab. |
| Crescent | Mintan | Summit. |
| Creedmoor | Star | Beaver. |
| Crisman Mammoth. | Tintie | Juab. |
| Crystal | Mount Baldy | Pi Ute. |
| Deer Trail | do | Do. |
| Dixon | Bingham | Salt Lake. |
| Elephant | Star | Beaver. |
| Emily | Bingham | Salt Lake. |
| Emma | Little Cottonwood. | Do. |
| Eureka Hill | Tintic | Juab. |
| Evergreen | Little Cottonwood. | Salt Lake. |
| Fraction | Bingham | Do. |
| Gem | do | Do. |
| Giant Chief | do | Do. |
| Gilman & Salisbury. | do | Do. |
| Goodrich | Little Cottonwood. | Do. |
| Greeley | Bingham | Do. |
| Green-eyed Monster. | Mount Baldy | Pi Ute. |
| Haskins | Bingham | Salt Lake. |
| Hazelgrove & Co. | do | Do. |
| Highland | do | Do. |
| Hooper | do | Do. |
| Horn Silver | San Francisco | Beaver. |
| January | West Tintic | Juab. |
| J. B. Rogers | Bingham | Salt Lake. |
| Joab Lawrence | Little Cottonwood. | Do. |
| Jordan | Bingham | Do. |
| Julia | do | Do. |
| Kandorah | Star | Beaver. |
| Kilkenney | Bingham | Salt Lake. |
| Julian Lane | Mono | Juab. |
| Last Chance | Bingham | Salt Lake. |
| Do | Harrisburg | Washington. |
| Lead | Bingham | Salt Lake. |
| Live Yankee | American Fork | Do. |
| Lucky Boy | Bingham | Do. |
| Magnolia | Star | Beaver. |
| Mammoth | do | Do. |
| Do | Tintic | Juab. |
| Marion | Little Cottonwood. | Salt Lake. |
| Markham | Bingham | Do. |
| Milk Maid | Silver Lake | Do. |
| Miller | Bingham | Do. |
| Morehouse | Star | Beaver. |
| Murphy | Bingham | Salt Lake. |
| Nabob | Beaver Lake | Beaver. |
| Nast | Bingham | Salt Lake. |
| Neptune | do | Do. |
| North Star | Tintie | Juab. |
| Do | Little Cottonwood. | Salt Lake. |
| Northern Spy | Mono | Juab. |
| O. K | Star | Beaver. |
| Ontario | Mintan | Summit. |
| Pluto | Mount Baldy | Pi Ute. |
| Roaring Lion | Mintan | Summit. |
| Sampson | do | Do. |
| Savage & Hoosier | Star | Beaver. |
| Savage | Harrisburg | Washington. |
| Scotia | West Tintic | Juab. |
| Silver Bell | American Fork | Salt Lake. |
| Silver Key | Mintan | Summit. |
| Silver Shield | Star | Beaver. |
| Silver Star | do | Do. |
| Southern Tier | Mintan | Summit. |
| Spanish | Star | Beaver. |
| Stalwart | do | Do. |
| Stewart | Bingham | Salt Lake. |
| Stormont | Harrisburg | Washington. |
| Sundown | Star | Beaver. |
| Sunset | Bingham | Salt Lake. |
| Tawanga | do | Do. |
| Telegraph | do | Do. |
| Tewarkee | do | Do. |
| Tintic | Mono | Juab. |
| Uranus | Star | Beaver. |
| Utah | Bingham | Salt Lake. |
| Vallejo | Little Cottonwood. | Do. |
| Virginia | Bingham | Do. |
| Wahsatch | do | Do. |
| War Eagle | Mono | Juab. |
| Wild Dutchman | American Fork | Salt Lake. |
| William | Bingham | Do. |
| Winnemucca | do | Do. |
| Yosemite | do | Do. |

## WASHINGTON TERRITORY.

| Name of mine. | District. | County. |
|---|---|---|
| Placers | Skagit River | Whatcorn. |
| Do | Snake River | Whitman. |
| Shaffer | Pechasteu | Yakuna. |
| Swank | Swank | Do. |

# PART III.

# MISCELLANEOUS.

# MISCELLANEOUS.

## *THE CONDITION OF THE MINING INDUSTRY OF CALIFORNIA IN 1883, WITH REFERENCE TO THE PRODUCTION OF THE PRECIOUS METALS.*

By Walter A. Skidmore.

While there has not occurred in California during the past year any very important mineral discovery, or other notable event in the mining world, the year has, nevertheless, been one of general prosperity, and, in some departments of mining, of marked success.

Quartz operations have been everywhere active, having been revived in some of the partially neglected districts, and in several instances extended into new localities. In the more central counties of the State, where this branch of mining was first inaugurated, considerable progress has been made. Disappointments, failures, and losses continue to occur, but not with so much frequency as formerly.

After having been suspended for a number of years, work has been resumed on many mines in Inyo, Moño, San Bernardino, and other remote counties, such resumption of operations having been mainly due to the extension of railroads into or near these mining sections.

Although the bullion product of California is small compared with what it once was, this State still maintains its place at the head of American gold producing States and Territories, having last year turned out that metal to the value of $13,182,188.

It is true, the gold production at first was nearly all distributed among the working miners, but of late years capital has come in for a share of that taken out. As the wages of the California miner continue, however, to be about $2.50 per day, his yearly earnings amount to fully as much as those of his predecessors. The changes wrought to the disadvantage of labor during the past twenty years have not been so great as is generally supposed.

In estimating the bullion product of California it is not the custom of her statisticians to include the value of the lead and copper output of the State, as is done in most other countries. The value of the quicksilver, iron, coal, copper, borax, salt, petroleum, and various other metals and minerals produced here, amounts to several million dollars every year, though none of these figures appear in the bullion statistics of the State.

In mining for the above products and converting them into marketable shapes there are employed a large number of men in California, as many as three or four thousand being engaged in the quicksilver and coal mines alone. As many of these metals and minerals occur here of good quality and in great abundance, the business of utilizing them must give rise, at no distant day, to a variety of important industries.

As has been the case for several years past, California continues to employ a larger mining population than the State of Colorado; but while she turns out a smaller amount of bullion, the conditions under which the precious metals are produced in these two States are unlike. In Colorado a few large companies employ a comparatively small number of men, and turn out a large amount of bullion; but in California the gold produced is distributed among many small companies, most of them partnership concerns, composed of a few individuals. A majority of the miners in this State are men who own the claims, sharing among themselves the fruits of their labors, whether they be much or little. This extended ownership grows out of the peculiar character of the gold-bearing deposits here, and the methods and appliances made use of in working them. Also, from the fact that the California miner would rather earn $2 working for himself than $3 on hire, the claims are not consolidated.

The great production of gold in California for many years was due to the fact that the number of men then engaged in mining was much larger than that of late years. Most of the gold gathered during the earlier period lay near the surface; nature, through the employment of her various processes of disintegration, erosion, and transportation, having brought it within easy reach. For the first ten or twelve years the annual bullion production of the State averaged about $55,000,000. Of late years the annual bullion production of the State has averaged about $18,000,000, with a mining population of not much over 35,000, making their yearly earnings more than they were during what has generally been looked upon as the more prosperous era of gold mining in the State.

So extensive are the California gold fields, and so diversified the character of the deposit, that they afford ample room for their present occupants. Current wages could be made here by a much larger number of miners than are now engaged; and that a very numerous population will yet find remunerative employment in the various branches of gold mining in California may be considered certain. The placers of the State have been extensively worked only on the surface, and have not as yet been wholly exhausted. The hydraulic gravel banks, the beds of the ancient and modern rivers, the contents of many deep-lying basins, the quartz and seam mines, with a great area of dry diggings, some located in gulches and flats, and some out on the rolling prairies, remain almost intact, hardly more work having been done on some of these deposits than sufficed to determine their extent and prospective value.

The tailings from the hydraulic mines, which carry much gold, may yet come to be extensively and profitably worked, and even the ocean beaches, under improved modes of washing, will some day be made to pay at least living wages. With resources so ample the business of gold mining should give employment to a large population and reach a long life in California.

From its maximum, $85,000,000 in 1852, the annual bullion product of California gradually declined till 1882, when it reached its minimum, a little less than $17,000,000. Since then there has been a slight increase, the product of the State amounting for the past three years to about $18,000,000 per annum.

While the mining districts of California possess some agricultural resources, these alone are not sufficient to support a numerous white population. Suplemented, however, by a product of the mines, now also comparatively limited, these two industries would suffice to the comfortable subsistence of many white inhabitants, who could profitably engage in farming at those seasons of the year when mining cannot be carried on advantageously. To permit the placers to be hurriedly and wastefully worked out by the Chinese would be to temporarily populate the country with a race who pay no taxes, who shirk all public duties, and contribute nothing towards the general good.

Gold was discovered in California by James H. Marshall, January 19, 1848, at Coloma, on the middle fork of the American River, about 30 miles from Sacramento City, the capital, and nearly the geographical center of the State. Prior to that time the inhabitants of the State were engaged exclusively in the business of stock-raising. The cultivation of the soil was limited to the production of such cereals and vegetables as were required for the actual consumption of the people, who were few in number, the population of the Sacramento Valley not exceeding fifty or sixty white people.

At the present time mining for gold is the principal industry in fifteen of the fifty-two counties of the State, and is a large industry in five other counties. The census of 1880 showed the aggregate population of the mining counties to be 127,858 souls, nearly all of whom are dependent upon gold mining.

The amount of money invested in the gold mines of California and the total gold production of the State has been a matter of judicial investigation in the so-called "débris litigation." Competent persons estimate that the investments in opening and working the gold mines will aggregate $150,000,000, of which two-thirds were expended on the hydraulic mines proper. The balance has been used in opening and operating drifts and quartz mines.

The gold gravel deposits of California are more extensive than those known in any other part of the world. Those of Siberia come next. The amount of gold remaining in the gravel mines of California is estimated to be greater than their past production.

It is estimated that it will require fifty years to work out ground already opened and controlled by the present canals and reservoirs, provided the present system of mining be not eventually prohibited by the courts. It was judicially found in the Woodruff case, wherein only the mining region on the tributaries of the Yuba was a subject of consideration (although the principle affected all hydraulic mining), that, "approximately, according to the evidence, over 100,000,000 cubic yards from these mines had been washed out by the hydraulic process," and 700,000,000 cubic yards remain to be washed out.

The ordinary yield of the gravel channels in the northern counties is from $40,000 to $50,000 per acre, though there are exceptional instances of much greater production—in one case, at French Corral, Nevada County, reaching nearly $200,000. In the southern counties the gravel deposits are not so deep, and the product has varied from $10,000 to $40,000 per acre.

The basis of valuation of hydraulic ground predicated on returns per cubic yard has long since been obsolete. The measure of value is the product per miner's inch; this in some instances known to the writer has reached $1 per inch. The value and force of a miner's inch will be described in another portion of this article.

The great expense attending the operating of hydraulic mines has led to the consolidation of numerous claims by large companies. The expenditures in the construction of reservoirs, ditches, and bed-rock tunnels is given in the following statement compiled from official sources:

| | |
|---|---|
| North Bloomfield and Milton | $4,079,321 |
| Excelsior, of Smartsville | 2,857,166 |
| Gold Run | 433,335 |
| Blue Tent | 755,000 |
| El Dorado Deep Gravel | 1,008 611 |
| Eureka Lake | 2,500,000 |
| South Yuba | 2,000,000 |
| Spring Valley | 2,000,000 |
| La Grange | 650,000 |

*The rainfall of California.*—As the rainfall is an important factor in the production of gold in California, it may be of interest to place on record the rainfall at Sacramento from the years of the discovery of gold to the present time.

The following table has been compiled with great care by Sergeant Barnick from the records of Dr. T. M. Logan, Dr. F. W. Hatch, and those of the United States Signal Service. It is presented as published in the Sacramento Record-Union.

| Year. | Total for year. | Season. | Total for season. |
|---|---|---|---|
| | *Inches.* | | *Inches.* |
| 1849 | ........... | 1849–'50 | 36.00 |
| 1850 | 19.50 | 1850–'51 | 4.71 |
| 1851 | 15.10 | 1851–'52 | 17.98 |
| 1852 | 27.00 | 1852–'53 | 36.36 |
| 1853 | 19.99 | 1853–'54 | 20.06 |
| 1854 | 19.83 | 1854–'55 | 18.62 |
| 1855 | 18.56 | 1855–'56 | 13.76 |
| 1856 | 14.26 | 1856–'57 | 10.46 |
| 1857 | 12.91 | 1857–'58 | 15.00 |
| 1858 | 16.80 | 1858–'59 | 16.08 |
| 1859 | 16.86 | 1859–'60 | 22.09 |
| 1860 | 19.19 | 1860–'61 | 16.10 |
| 1861 | 21.38 | 1861–'62 | 35.56 |
| 1862 | 27.44 | 1862–'63 | 11.58 |
| 1863 | 12.20 | 1863–'64 | 7.87 |
| 1864 | 19.27 | 1864–'65 | 22.51 |
| 1865 | 11.15 | 1865–'66 | 17.93 |
| 1866 | 26.52 | 1866–'67 | 25.30 |
| 1867 | 30.03 | 1867–'68 | 32.79 |
| 1868 | 19.50 | 1868–'69 | 16.64 |
| 1869 | 18.19 | 1869–'70 | 13.57 |
| 1870 | 10.21 | 1870–'71 | 8.47 |
| 1871 | 18.92 | 1871–'72 | 23.65 |
| 1872 | 19.17 | 1872–'73 | 14.21 |
| 1873 | 18.20 | 1873–'74 | 22.90 |
| 1874 | 17.92 | 1874–'75 | 17.70 |
| 1875 | 23.31 | 1875–'76 | 26.53 |
| 1876 | 18.12 | 1876–'77 | 8.96 |
| 1877 | 8.44 | 1877–'78 | 24.86 |
| 1878 | 23.45 | 1878–'79 | 17.85 |
| 1879 | 22.37 | 1879–'80 | 26.47 |
| 1880 | 31.90 | 1880–'81 | 26.57 |
| 1881 | 20.71 | 1881–'82 | 16.51 |
| 1882 | 18.06 | 1882–'83 | 18.11 |
| 1883 | ........... | 1883–'84 | ........... |
| Totals | 636.55 | ........... | 663.71 |
| Mean for twenty-four years | ........... | ........... | 19.521 |

Since the introduction of hydraulic mining on a large scale the mining companies have kept an accurate record of the rainfall at various points in mining counties. I have selected those of Nevada City as being nearest the center of the mining region. It will be observed that the rainfall is much greater than in the valley. Nevada City is about 60 miles northeast of Sacramento, and is situated 3,000 feet above sea-level. The difference in the rainfall as compared with the valley is remarkable. The contrast is still greater when compared with the records taken at Bowman Dam, near the summit of the Sierra Nevada, 6,000 feet above sea-level. The figures for this point are given from 1871 to 1879.

*Rainfall at summit of Sierra Nevadas and at Nevada City from season* 1863–'64 *to season of* 1882–'83.

| Season. | Rainfall at summit of Sierras. | Rainfall at Nevada City. |
|---|---|---|
| | *Inches.* | *Inches.* |
| 1863–'64 | .......... | 17.28 |
| 1864–'65 | .......... | 54.49 |
| 1865–'66 | .......... | 59.26 |
| 1866–'67 | .......... | 70.55 |
| 1867–'68 | .......... | 99.70 |
| 1868–'69 | .......... | 49.04 |
| 1869–'70 | .......... | 45.98 |
| 1870–'71 | .......... | 39.23 |
| 1871–'72 | 102.22 | 74.79 |
| 1872–'73 | 55.45 | 38.70 |
| 1873–'74 | 88.19 | 62.91 |
| 1874–'75 | 50.27 | 45.95 |
| 1875–'76 | 93.03 | 67.38 |
| 1876–'77 | 44.71 | 32.31 |
| 1877–'78 | 64.78 | 56.44 |
| 1878–'79 | 75.46 | 58.93 |
| 1879–'80 | 95.60 | 62.92 |
| 1880–'81 | 85.22 | 61.01 |
| 1881–'82 | 67.09 | 45.01 |
| 1882–'83 | .......... | 44.77 |

*Mining canals and reservoirs.*—According to the last official reports of the surveyor-general of California there were in the State 575 mining ditches, aggregating 4,992 miles in length. This would include many branch ditches of the large companies, which are not embraced in the following table compiled for the State mineralogist, Professor Hanks, and embodied in the report for 1882. The table is submitted with some alteration and correction.

*Table of mining ditches tributary to the Sacramento and San Joaquin Valleys.*

| Name. | County. | Character. | Length. | Capacity. | Cost. |
|---|---|---|---|---|---|
| | | | *Miles.* | *Miner's inch.* | |
| Auburn and Bear River Canal | Placer | Mining and irrigating. | 75 | 3,000 | $350,000 |
| Amador Canal Company | Amador | do | 66 | 2,000 | 400,000 |
| Blue Tent | Nevada | Mining | 32 | 2,000 | 150,000 |
| Brandy City | Sierra | do | 17 | 22,000 | 90,000 |
| Cedar Creek, Dutch Flat | Placer | do | 50 | 45,000 | 125,000 |
| Cherokee and Spring Valley | Butte | do | 56 | 22,000 | 500,000 |
| California Water Company | El Dorado | Mining and irrigating. | 125 | 4,500 | 550,000 |
| Dardanelles Company | Placer | Mining | 17 | 3,000 | 125,000 |
| Eureka Lake and Yuba Canal | Nevada | do | 163 | 5,800 | 723,343 |
| Excelsior, Smartsville | Yuba | Mining and irrigating. | 110 | 5,300 | 1,000,000 |
| El Dorado Canal | El Dorado | Mining | 26 | 5,000 | 650,000 |
| Gold Run Ditch | Placer | do | 26 | 2,500 | 150,000 |
| Iowa Hill Company | do | do | 27 | 4,500 | 175,000 |
| Hendricks Company | Butte | Mining and irrigating. | 46 | 2,000 | 163,150 |
| Little York and Liberty Hill | Placer | Mining | 35 | 3,500 | 150,000 |
| Milton Company | Nevada | do | 100 | 3,000 | .......... |
| Mokelumne Hill and Campo Seco. | Calaveras | Mining and irrigating. | 55 | 1,200 | 500,000 |
| North Bloomfield Company | Nevada | Mining | ........ | 3,200 | .......... |
| Natoma Canal | Sacramento. | Mining and irrigating. | 16 | 3,500 | 160,000 |
| Phœnix Ditch Company | do | do | 100 | 4,000 | 880,000 |
| Power's Ditch | Butte | do | 30 | 2,000 | 75,000 |
| South Yuba Canal | Nevada and Placer. | Mining | 123 | 7,000 | 800,000 |
| Tuolumne Water Company | Tuolumne | do | 75 | 3,600 | 1,500,000 |
| Union Water Company | Sierra | do | 50 | 1,500 | 350,000 |

The hydraulic mining companies utilize the water by storing it in reservoirs and drawing it off during the dry seasons by means of canals, or, as they are termed in California, "ditches."

The following table shows the magnitude of the principal reservoirs in Nevada County, supplying water to the North Bloomfield Gravel Mining Company, the Milton Mining and Water Company, and the Eureka Lake and Yuba Canal Companies consolidated:

| Name of reservoir. | High water area. | Height of dam. | Capacity. |
|---|---|---|---|
| | *Acres.* | *Feet.* | *Cubic feet.* |
| Saw-Mill Flat | 806. 0 | 39 | 70, 000, 000 |
| English (now broken) | 363. 0 | 131 | 535, 000, 000 |
| Bowman | 490. 0 | ........... | 796, 700, 000 |
| Eureka Lake | 337. 0 | 64 | 640, 000, 000 |
| Fancherie | 90 0 | 21 | 58, 800, 000 |
| Weaver Lake | 83. 5 | 22 | 57, 800, 000 |

*Miner's inch.*—The term "miner's inch," as applied to the force, duty, and value of water, is so often used in describing the mining industry of California, and appears so many times in this article, that it is fitting that it should be described at some length. Dr. Henry De Groot, in his report to the State mineralogist, Prof. H. G. Hanks, says: "The miner's inch that has come to be most widely accepted is the quantity of water that will flow from an orifice 1 inch square, through a 2-inch plank, with still water standing to a depth of 6 inches above the top of the orifice. Through a plank so perforated 2,274 cubic feet of water, or nearly 17,000 gallons, will escape in twenty-four hours. Where this method of measurement is practically adopted a long horizontal slit, 1 inch high, is made in the discharging box, a slide being used to regulate the number of inches which it is intended shall escape. The outlet orifice varies in length in different localities, as also does the depth of the still water, which is generally 6 inches, sometimes measured from the center and sometimes from the top of the orifice."

A. J. Bowie, jr., a well-known mining engineer, recently made a series of experiments to determine the effective value of a miner's inch discharged through a rectangular aperture 50 inches long, 2 inches wide, and pressure of 16 inches above center of opening. The result was:

| | Cubic feet. |
|---|---|
| One miner's inch, 1 second | .2499 |
| One miner's inch, 1 minute | 1. 4994 |
| One miner's inch, 1 hour | 89. 9640 |
| One miner's inch, 24 hours | 2, 159. 1360 |

It is assumed that 2,274 cubic feet of water are equivalent to the discharge of 1 miner's inch in twenty-four hours, and that the duty of a miner's inch is the removal of from 2½ to 3½ cubic yards, in place, in twenty-four hours. This estimate is based on bottom or cemented ground which is first shaken up by the use of explosives, and afterwards broken by manual labor. The effective work of a miner's inch on top ground would be about twice as much as on bottom. Hydraulic engineers have ascertained that the duty measures about as the square of the inclination of the sluice, *i. e.*, a sluice with a grade of 12 inches to 12 feet will carry four times as much as a sluice with one-half that grade. With the above maximum grade bowlders weighing from 200 to 500 pounds pass through the sluice with ease and rapidity, and larger bowlders, weighing from 1,000 to 2,000 pounds, pass slowly through.

The effective results of water on hydraulic banks was determined by close observation in 1882 at several leading mines, as follows:

| Name. | Water. | Earth moved. |
|---|---|---|
| | *Miner's inches.* | *Cubic yards.* |
| North Bloomfield Mine | 2,800 | 11,200 |
| Milton | 3,300 | 11,400 |
| Omega | 1,500 | 7,500 |
| Conly and Gowell | 1,700 | 10,200 |
| Excelsior | 1,600 | 6,400 |
| Chadwick and Campbell | 1,200 | 14,400 |
| | 12,100 | 61,100 |

These observations were made simultaneously, but the conditions were varying, with respect to the consistency of the gravel. The result will show a duty of an average of 5 cubic yards per miner's inch in Nevada County, though this would include some top dirt.

*Hydraulic mining.*—What is technically known as hydraulic mining was introduced in California on a small scale in 1852 or 1853, and consisted in the discharge of water under pressure against banks of auriferous material. This process has been known since the earlier historical times, and nearly all the gold the world had produced prior to the seventeenth century was mined by this process, though on a very limited scale as compared to the system at present in use in California.

The process was fully known to the Romans, who, according to Pliny, pursued it on a large scale in ancient Spain. It seems from the personal observation of Mr. Alexander Del Mar, who recently traveled extensively in that country, that there exists no less than twelve districts of these abandoned mines, all of them similar in formation to the gravel deposits of California. There are evidences that that country was once inhabited by a large and thrifty population dependent upon this class of mining. He found the remains of ditches, dams, and artificial reservoirs, showing the great extent of mining prosecuted by the Roman colonists. Hydraulic mining in modern times is not confined to California, but is carried on in Australia, Russia, Brazil, and South Africa. All of these countries are supplied by California with machinery.

The gravel banks of California vary in height from 100 to 200 feet. The gold is distributed generally in very fine particles throughout the entire gravel bank. The gravel is broken down by the force of water, and is propelled along the flume, which has as great an inclination or grade as is practicable within given limits. Of the gravel thus broken down and carried along, the heavier portions, consisting of bowlders, cobbles, and large stones, remain at or near the "dump" or end of the flume, while the lighter portions are carried along to a greater distance. In working the bottom or lower stratum, the material is so solid and compact and so firmly cemented together that blasting powder is required to break it up and disintegrate it before the water is applied, the strongest force of water under the greatest attainable pressure being insufficient for that purpose. The bottom of the flume is so constructed as to retain the gold so far as practicable, the retention being aided by the use of quicksilver, with which the gold amalgamates. The tailings and water from the mines are discharged into the nearest and most accessible outlets presented by the most convenient ravines, cañons, or rivers. These channels yield from $500 to $2,000 a linear foot in gold, and from them, directly and indirectly, has been produced, since 1849,

$1,000,000,000. These ancient channels were discovered, located, and opened about the year 1852, and by the year 1855 were very extensively worked.

Until the year 1875 the miners chiefly confined their work to the upper or surface gravel, which was washed through sluices with steep inclinations, resulting in the deposit of a large amount of this light material in the streams and rivers of the State, of which there now remains in the beds of the American, Bear, and Yuba Rivers and their tributaries not less than 300,000,000 cubic yards. Since 1876 the miners have confined their work chiefly to the removal of the dense and heavy bottom material, which is washed through long and expensive bed-rock tunnels with comparatively slight inclinations. The amount of the material now moved with the same amount of water is not over one-sixth of what was moved by the earlier washings.

The heavy bottom gravel now being washed finds a permanent lodgment in the beds of the streams in which it is deposited, forming in many places dams in the rivers, on which the flood waters of the streams have but little effect. The greater these deposits become in the river beds the less liable the danger of their removal by the floods, by reason of the increased width of the stream and the consequent diminished velocity of the waters. They become recemented in the present rivers; so much so, in some cases, as to require the action of powder to remove them. The dams formed by these deposits of heavy material often hold back in the rivers the lighter surface gravel which was washed in times past.

Hydraulic mining, as now carried on in this State and as it will be prosecuted in the future, does not involve or require the washing away of large quantities or any considerable quantity of earth containing no gold. The cubic contents of the non-paying earth to be washed in the future form but a small proportion of the auriferous gravel to be washed by the hydraulic process.

*The gravel channels of ancient rivers.*—The ancient gravel channels of California were formed, it is believed, during the Pliocene period, and extend from Mariposa County in the south to Siskiyou County in the north, having an aggregate length of about 350 miles. The auriferous area has been estimated to be 200 square miles. These channels are from 200 to 400 feet wide on the bottom, and sometimes as much as 2,000 feet wide on the surface. They are filled with gravel from depths of 20 to 400 feet. The deposit at the bottom consists of bowlders, cobbles, gravel, and sand firmly cemented together. This bottom deposit is commonly known as the "blue lead" from its color, and varies in thickness from 20 to 120 feet. Above the "blue gravel" is found the "top gravel," consisting of sand and occasional bowlders, with sometimes layers of pipe-clay. Near the surface is found red soil, varying from a few feet to 20 feet in thickness. Gold is distributed very uniformly through the entire mass of gravel, being most abundant near the bed-rock. These ancient channels are sinuous in their course, and have many branches and tributaries. Their grades vary from 20 to 300 feet per mile—sometimes confined within narrow banks, and again assuming lacustrine proportions. They undoubtedly carried more water than do the present rivers of California. The fact of the material being coarser and larger at the bottom is due to the great velocity of the rivers where confined in narrow channels. As the filling increased the transporting power of the streams became less from the diminished depth of the water, and hence the latter deposit was of firm material.

The principal gravel mines of California are situated in the counties of Yuba, Sierra, Placer, and Nevada, in the region drained by the Feather, Yuba, and Bear Rivers. It has been estimated from careful canvass of this industry that there are on the drainage system of these rivers three hundred mines or tracts of mining lands which have been worked within the past three years, though not perhaps simultaneously, by the method distinctively known as "hydraulicking," besides numerous "drifts, "rivers," and placer mines, which are dependent upon water washing. The magnitude of these mines, whether hydraulic or drift, depends on the width and length of the channel.

The San Juan Ridge at North Bloomfield has a channel about 200 feet wide on the bottom and 800 feet wide at the surface. The company own about 19,000 linear feet of the channel, which has been continuously worked since 1853—the top dirt having been removed in early times. The value of that channel has been demonstrated to be about $850 per linear foot, say $4,500,000 per mile. To reach the deep or bottom gravel, they drove a tunnel 11,874 feet in length, which was not completed until 1874. Since that time the company has worked 3,500 feet of the main channel, leaving 15,500 feet to be worked, which it is estimated will produce about $13,000,000. The company's outlet tunnel also commands about 1½ miles of channel, which it may be estimated will produce $8,000,000, or, say, a total of $21,000,000, based on estimates of past production covering a period of about twenty years.

The mines of the Milton Company have a length of about 17,500 feet, which, it is estimated, will yield at the rate of $5,500,000 per mile. The tunnels of this company command about 2 miles more of channel. The contents of this area of unworked ground will not fall short of $20,000,000.

The channel on which the Bloomfield and Milton Companies are operating has been opened in so many places that its position has been accurately determined and its contents approximately ascertained. Within the limits of the San Juan Ridge alone, in the county of Nevada, it is known that there remains to be abstracted about $90,000,000. In other portions of the county the position of the gravel channels is not at present so well known. It is, however, known that they exist for many miles in length, and the gross yield will vary between $4,000,000 and $6,000,000 per mile.

The North Bloomfield property, including mines, tunnels, ditches, and reservoirs, has cost the present company about $2,500,000. Its tunnels cost about $575,000; its reservoirs $246,707, and its ditches $466,768.

The property of the Milton Company, including mines, tunnels, reservoirs, dams, and ditches, cost about $2,000,000. Its tunnels, aggregating more than 3 miles in length, cost from $600,000 to $700,000, and its ditches, about 84 miles in length, cost $462,698, and its reservoirs $214,000.

The following data respecting these two representative companies are compiled from their books:

*North Bloomfield Gravel Mining Company.*

| | |
|---|---|
| Expended on mines | $1,595,000 |
| Borrowed money | 500,000 |
| Interest on assessments pending development | 800,000 |
| | 2,895,000 |

*Milton Mining and Water Company.*

| | |
|---|---:|
| Expenses from assessments | $1,263,500 |
| Borrowed on mortgage | 300,000 |
| Interest on assessments pending developments | 541,000 |
| | 2,104,500 |
| Total cost of both companies | $4,999,500 |
| Dividends paid on North Bloomfield | 776,250 |
| Dividends paid on Milton | 687,604 |
| | 1,463,854 |

The total payment from net earnings for dividends, and bonds (principal and interest), $2,751,854.

It is estimated on the basis of past production that $25,000,000 yet remains in the unworked ground belonging to these companies.

*Table showing operations of the North Bloomfield and Milton Companies from* 1877 *to* 1883, *inclusive.*

| Year. | Gold product. | Water sales. | Net profit. | Dividends. |
|---|---:|---:|---:|---:|
| 1877 | $670,774 57 | $6,753 67 | $364,045 48 | $45,000 |
| 1878 | 849,036 16 | 9,694 53 | 501,181 05 | 484,498 |
| 1879 | 794,517 90 | 9,090 84 | 462,821 42 | 466,390 |
| 1880 | 665,710 60 | 12,395 26 | 264,075 49 | 105,396 |
| 1881 | 637,682 06 | 24,233 03 | 325,226 62 | ........ |
| 1882 | 802,190 40 | 5,134 56 | 416,208 62 | 223,424 |
| 1883 | 738,985 97 | 7,031 64 | 400,089 77 | 217,896 |

NOTE.—The main reservoir of the Milton Company broke June 18, 1883, and the company was deprived of the benefits of half a year's run, thereby materially decreasing the profits. The water stored in the reservoir was ample to continue operations for the balance of the season.

*Canals and reservoirs.*—The cost of maintaining the ditches or canals is an important item of expense. It embraces the items of supervision, repair, watchmen, &c. It costs the Milton $40,000 and the Bloomfield $30,000 per year to keep their ditches in an effective condition. The cost of maintenance in the Milton is 6.10 cents per inch; in the Bloomfield 2.27 cents per inch. These ditches cost originally $7,000 to $10,000 per mile. The various reservoirs supplying these mines during the dry season have an impounding capacity of about 5,000,000,000 cubic feet of water. They are situated at elevations of from 5,000 to 7,000 feet above sea level. These two mines employ four hundred white miners, at wages varying from $2.50 to $3 per day, and disburse yearly in the immediate neighborhood of the mines over $300,000.

The total storage capacity of the mining reservoirs of the State is approximately as follows:

| | Cubic feet. |
|---|---:|
| North Boomfield Gold Mining Company's reservoirs hold | 1,050,000,000 |
| Milton Mining and Water Company (now broken) | 650,000,000 |
| Eureka Lake and Yuba Canal Companies (consolidated) | 1,130,000,000 |
| South Yuba Water Company | 1,800,000,000 |
| Omega and Blue Tent Mining Company | 300,000,000 |
| Spring Valley Gold Mining Company | 300,000,000 |
| California Water Company | 600,000,000 |
| El Dorado Company | 1,070,000,000 |
| Small reservoirs on Feather, Yuba, and Bear Rivers | 700,000,000 |
| Estimates of reservoirs in Amador and Calaveras Counties | 400,000,000 |
| Total | 8,000,000,000 |

*Smartsville channel system.*—The Smartsville gravel deposits are among the most extensive in California. The banks are from 180 to 200 feet high. The first hundred feet from the bottom is very hard blue cement, mixed with pebbles and large bowlders; above this white compact cement of less coarse material. This bank resisted the force of 1,400 inches of water under 220 feet of pressure. Blasting was resorted to, and as many as 2,000 kegs of black powder have been used at a single blast. This ground has been opened at enormous expense by means of long tunnels 8 or 9 feet high and 8 feet wide, driven through a rim rock of metamorphic slate at an average cost of $50 per linear foot. The aggregate cost has been at least $1,000,000, exclusive of the cost of pipes, flumes, and other incidents connected with a perfect "rig," as it is called by the miners. The outfit of some of these claims cost $10,000. Up to 1882 the Excelsior had run 17,000 feet of tunnel, and other companies 4,300 feet. The original cost of the ditches bringing water on this ground was $11,000,000, exclusive of the cost of their maintenance. This channel carried gold from grass root to bed rock. Two miles of the channel yielded $14,000,000, claims on the rim $2,000,000, and there yet remains about 1 mile of channel to be worked. The claims of this district were among the most profitable in the State until last year, when they were temporarily enjoined, thereby materially diminishing the gold product of 1883.

*State Creek Basin channels.*—One of the most extensive and productive mining regions of California is that of State Creek Basin, situated on the banks of State Creek, a tributary of the North Yuba. This mining territory, which embraces a drainage area of 120 square miles, is situated on the borders of Sierra and Plumas Counties. There are here exposed and partially developed two channels aggregating 15 miles in length. These channels have a width of from 500 to 600 feet, and a depth of from 50 to 60 feet. The grade of the old rivers is about 300 feet to a mile. The product of this district has been more than $100,000,000, principally from placer and drift mining. The greater portion of this sum was extracted by the primitive methods in use prior to 1862. Hydraulic mining on a large scale is limited by the water supply, which does not exceed 7,000 to 10,000 inches per twenty-four hours for four months in the year. The drift mines, however, maintain a supply for eight months of the year. The auriferous contents of the explored ground on the rims of this basin may be estimated as double the past products. The contents of the unexplored ground is simply a matter of conjecture not pertinent to the scope of this article. Not more than one-fifth of the explored ground has been worked out.

*Butte County mines.*—Hydraulic mining is also largely prosecuted and with great profit in the counties of Butte and Plumas. In the former is situated the Spring Valley Company, one of the largest and best fitted out mines in the State. The product for the present year will be about $240,000. The results of many years show that the bottom ground pays about $8,000 to 100 feet square, or nearly $35,000 per acre. The company mine banks 300 feet high, throwing down from 5,000 to 8,000 cubic yards per day, using 2,200 inches of water. A miner's inch at this claim is estimated to be 17,000 gallons in twenty-four hours, and its effect to remove 3 to 4 cubic yards per inch. On the bottom ground it will not exceed 2 cubic yards. The ground pays from the top. This company has expended nearly $400,000 in the purchase of low lands in the Sacramento Valley, which they are reclaiming by filling the depressions with the débris from their mines. This land, once reclaimed, will be a source of revenue to the company.

The Miocene Company of New York, owning a large and valuable territory on the banks of the Feather River, with water rights and ditches, are at present suspended by injunction.

*The débris litigation.*—As the product of gold from the hydraulic method of mining is likely to be checked for a few years by injunctions recently placed on the leading mines, which will continue in force until dams are built or the injunctions dissolved on appeal to the Supreme Court of the United States, it may not be inappropriate to review the history of this litigation, without expressing any opinion on its merits, as that is the province of the courts. The litigation commenced in September, 1876, by an action brought by J. B. Keyes, a farmer owning land on Bear River, alleging injury to his land by the operation of the miners. The suit was decided in favor of the miners on technical points, and was followed by numerous others, instituted by a union of farmers on the Yuba River. These culminated in a suit in the United States circuit court, brought September, 1882, entitled Woodruff *vs.* North Bloomfield *et al.*, wherein it was judicially determined that certain lands on or adjacent to the navigable waters of the State have been damaged by being covered with slickens or débris which is left on such land during stages of high water, being carried in suspension from the operation of hydraulic mines. Hence, several companies, being the largest producers from this class of mining, were united in an action brought by a representative of the Anti Débris Association, asking for an injunction on the ground that the operation of the miners constituted a nuisance, which injunction was granted with a modifying clause. The recent decision of the circuit court will have the effect to reduce the production of gold, for some time at least, to the extent of $10,000,000 or $12,000,000 per annum, as none of the defendant companies can profitably work their ground by any other than the hydraulic process.

These companies have recently discharged all their employés and given instructions to have the waste-gates thrown wide open, and will this winter let their 175 miles of canals and flumes, which were constructed at a cost of over $700,000, take care of themselves. The Milton Company, having 80 miles of ditches, costing $400,000, and the Eureka Lake Company 173 miles, costing $725,000, have likewise abandoned their ditch property, and the large force of men heretofore required to keep them in repair are now without occupation. The principal damages that will result to the property will be from snow slides, that may sweep some of the flumes away from their elevated posts on the precipitous mountain side. In case a modification of the decision is obtained, however, the breaks will in the spring be repaired and the water again turned on. Those of the tenders who have not emigrated will be reinstated. In the mean time, one man is kept at each of the dams to guard the movable property and see that the reservoirs are not tampered with.

In the higher regions of the Sierras the gold is found coarse, often in nuggets on the bed rock, but in the middle plane of the slope the gold on the bed rock is fine and generally evenly distributed throughout the bank. The pay is rarely in excess of 25 cents to the cubic yard, while in drifting a minimum of $3 to the cubic yard is necessary for profit.

*Drift mining.*—This mining industry is prosecuted in the high regions of the western slope of the Sierra Nevadas, where the ancient channels are buried under superincumbent volcanoes, ash and lava. It is the leading industry of Forest Hill Divide, in Placer County, and is extensively carried on in the counties of Sierra and Plumas; also on a small scale in El Dorado County.

The term "drifting" alludes to the method or process of extracting or washing the gold. The method of extracting is in many respects similar to that pursued in coal mining. A shaft or slope is sunk, or a tunnel run (if the nature of the ground will permit). When the pay gravel is reached it is cross-cut from rim to rim and gangways are run at right angles, laying off the ground in blocks. These are called "breasts." The main tunnel is always carried well ahead of the gangways. Pillars are left to support the main tunnel, which follows as nearly as practicable the gutter of the channel. The breasts are supported by temporary posts and by the "stacking" of the larger bowlders. As breast after breast is worked, the ground is abandoned and left to settle. Tunnels are sometimes run too low or too high; in the latter event the work must be commenced anew and at a more favorable point. If too low, an upraise shaft is raised until the gravel is tapped, when a main gallery is run above the tunnel bed and the ground worked as above described, the gravel being dropped to the main tunnel by chutes.

In the accompanying diagram of a drift mine, the main tunnel runs through the center and the gangways diverge on either side until the rim or limit of pay is reached. The main gallery or tunnel is usually 10 or 12 feet on bottom, 8 to 9 feet high, and 3 to 4 feet wide on the top; while the breasts are from 3 to 5 feet in height. Hence the area covered by the gallery and gangways bears a proportion in cubic contents to the whole ground worked.

In some counties the material is so strongly cemented as to require crushing by stamps or other mechanical appliances before washing, but on the Blue Lead of Sierra County this is not necessary. Here it is washed by projecting a stream of water under great head or pressure upon the loosened dirt. The gold, by reason of its great specific gravity, is caught in the riffled flumes and the tailings pass to the lower streams, where they are retained for future treatment, by means of dams, &c. The result of this class of mining is based on the yield per car-load, which is usually equal to 20 cubic feet, weighing 1¼ tons, corresponding to 15 cubic feet of material in place. The cost of mining and washing is about $1.33 per car-load, and the yield varies from $2 to $5 per car-load.

Expansion after breakage of ground is an important factor in the measurement (or approximation) of drift gravel. Nine cubic feet of ground in place, when broken will fill a box holding 12 cubic feet. Hence an estimate based on cubing the superficial feet and height is erroneous and calculated to mislead, as it would fall far below the actual output in car-loads.

The method of extraction and washing is so simple as to require no further description. The skill required in this class of mining is to follow the ancient channels, which always requires expensive prospecting directed by judgment and experience.

Claims of this nature rarely present any exterior evidence of their existence nor any surface indication of their line of continuance. They are usually located on theory predicated on the trend of channel in developed claims or on the contour of rim bed rock. A point having been selected, a prospect shaft is sunk to bed rock and drifts extended in various directions. The position of the channel being determined, perhaps by the sinking of several prospect shafts, a tunnel is run through the rim to intersect the channels and operations carried on commensurate with its extent. Some of these tunnels, with their continuation on the channel, are more than 6,000 feet in length. The cars are usually run in and out by mules, but in one instance, the Bald Mountain or Sierra Company, steam is used, the locomotive drawing 60 cars each trip. The channels are subject to disturbances and sometimes are temporarily cut off. These breaks are usually termed "lava flows," but in my opinion the material displacing the channel gravel is not lava. It is sedimentary magnesian pipe-clay, the result of some extinct stream of more recent age than the blue lead cutting across the channels and filling it with this material. In other words, it is like a wall or dam interposed across the stream, which must be cut through. This feature is no novelty on the ancient channels of Sierra County. The Bald Mountain Company encountered one which proved to be 500 feet in thickness, and materially retarded their progress northward. But on the other side the blue lead was found intact.

The writer visited a mine of this class in Sierra County last spring, and quotes from memoranda made on the ground the following statistics:

Working outlay of Ruby Mining Company, January, 1880, to April, 1883:

| | |
|---|---|
| Main tunnel construction | $62,874 36 |
| Improvements, buildings, roads, flumes, &c | 11,751 23 |
| General expense connected with working | 9,404 57 |
| Prospecting work | 8,203 14 |

The work embraced at date, April 22, 1883, 2,400 feet of main tunnel driven through solid bed rock, 1,217 feet of drifts on channel, and 150 feet of raises. Nearly all of this work was done before the mine commenced to yield a profit. As this in some measure is a representative mine, I append the statement of cost and profit during the period of my visit. This is presented for the purpose of showing cost of operation of this class of mines, where the ground is opened and the gravel can be washed, but if the gravel was cemented and required crushing or pulverizing by mechanical appliances the cost per car-load would be at least $2 per ton.

RECORD OF RUBY MINE FROM APRIL 16 TO 22, 1883.

| | |
|---|---|
| Running expenses of the mine: | |
| Labor—50 men at $3 | $150 00 |
| Outside men and management | 25 00 |
| Powder, fuse, caps, steel, iron, light, timber, and incidentals | 29 00 |
| Per day | 204 00 |
| Per week of six days | 1,224 00 |
| Running expense for Sunday | 30 00 |
| Full week | 1,254 00 |
| The result was: Car-loads of pay dirt | 709 |
| Car-loads of waste dirt | 200 |
| | 909 |
| The cost per car-load was | $1 34 |
| Yield: | |
| Head boxes cleaned up, 161 ounces at $17.50 | $2,817 50 |
| Lower boxes not cleaned up, estimated 1-7 of head | 402 50 |
| | 3,220 00 |
| The pay per car-load was | $3 64 |
| Profit net for week | 19 66 |

The Bald Mountain Company, adjoining the Ruby on the south, was more fortunate in opening their ground at very little expense. They commenced paying dividends within one year after ground was broken. The operations of this company are described in former reports. For the fiscal year prior to my visit the company had paid $61,200 in dividends from 107,300 car-loads.

*Drift mining in Forest Hill divide.*—The banks and bars of the Middle Fork of the American were noted for their richness in the early days of river and placer mining from 1849 to 1863. The product of the river claims would now be considered fabulous. Those who were not so fortunate as to acquire claims on the river followed up the gulches and ravines, working them by "rocker," "long tom," and "sluices," until the source of the river gold was discovered, 2,000 feet above the river bed, at the line of contact between the bed rock slate and the overlying capping of volcanic material. The original locations were made in squares; but subsequently the mining laws were amended and each locator was entitled to a certain frontage, with side lines extended back to the apex or the water-shed line of the ridge. The frontage, as regulated by the mining laws of Forest Hill district, was only 75 feet, the locations extending back to the center of the ridge. These claims were opened by tunnels, some of which attained a length of half a mile or more. The ground worked out yielded at the rate of $1,000,000 per mile of channel. The highest yield was in 1866, when the product was $440,000 from the Forest Hill group alone. The yield sometimes ran up to $10 per car-load, and equaled from $300 to $500 per linear foot of channels.

The Forest Hill Blue Lead of Placer County is evidently the remnant of an ancient river, now covered with many hundred feet of volcanic matter. It may be divided, for purposes of description, into two geographical sections, the lower and upper. The lower section presented itself on the sides of the ridge at Michigan Bluff, Bath, and Forest Hill, and terminated at Peckham Hill, where it was washed away when the great cañon of the Middle Fork of the American River was eroded. Its length between Michigan Bluff and Peckham Hill, allowing for the sinuosities of the channel, may be estimated at from 18 to 20 miles, the greater portion of which has been partially worked out. It is probable that the side exposure at Bath and Forest Hill was caused by the breaking off of a bend or elbow of the ancient river, which had its source higher on the divide.

The term "divide" in general use in the mountain regions of California is synonymous with "ridge," and is used to designate the high land between two converging rivers.

The source and termination of this channel or system of channels is purely a matter of theory. Its rims of slate rock are well exposed and are sometimes more than a mile apart, and its current must have been more than a thousand feet wide at stages of high water. The ancient channels of this region consist of detached fragments of the original deposit, cut off, in continuity, by the deep cañons of the present rivers.

The stratification of this channel was well exposed by the air shaft of the Breege & Wheeler claim, between Bath and Forest Hill, as follows:

| | Feet. |
|---|---|
| Volcanic matter | 280 |
| Quartz gravel | 12 |
| Compact quartz sand | 30 |
| Sand and gravel (soft ground) | 70 |
| Pay gravel of the "upper lead" | 8 to 10 |
| Total | 400 |

At this point the upper strata were drifted to a width of 400 feet. The upper stratum or "lead" was worked by Breege & Wheeler for more than twenty-five years. Below this occurred poor strata for a depth of 150 feet, when the lower stratum or bed-rock was reached, which proved richer than the upper. At no time since the discovery have operations been totally suspended on this claim, though there were periods when the channel was temporarily lost.

At date of writing a large force is at work, and there is renewed activity in many neighboring claims.

The Mayflower, situated west of the Breege & Wheeler, which was formerly extensively worked as a hydraulic claim, but now worked as a drift claim, presents some interesting features. At a depth of about 200 feet, and below the hydraulic ground, there is found what is called by miners a "false bed-rock." It consists of compact, gritty material, 140 feet in thickness, and lies horizontally. Below it was found the "lower lead" of blue gravel, which in the Breege & Wheeler (Paragon) ground at Bath, on the opposite rim, proved so rich. This intermediate formation is the product of volcanic action filling the ancient stream. Then occurred a period of quiescence, and subsequently the waters flowed very nearly on the course of the former bed of the primitive channels and formed what is now known as "the upper" lead. This was again succeeded by the volcanic flow which effectually closed the ancient river, compelling its waters to cut out a new channel, which was the origin of the present fork of the American River. This lava now forms the capping of the Forest Hill divide.

The Washington Company is engaged in sinking a prospecting shaft on the line of the Forest Hill channel, and should their operations be attended with success many other claims will be opened in 1884. More than one hundred mines have been worked on the channel delineated on the accompanying geographical map. Most of them have had their day. The production of gold from this channel may be safely estimated at $1,000,000 per mile in the aggregate. The production for any given distance worked has been greater at the upper end of the channel than at the lower—in other words, decreasing down stream. Taking the Forest Hill group alone, I find it stated by J. Ross Browne, United States Commissioner of Mining Statistics, that up to the date of his report of 1868 the Forest Hill group had yielded about $10,000,000. This amount must have been produced between 1852 and 1866, for I find from official sources that the yield of 1866–'70 was as follows:

| | |
|---|---|
| 1866 | $440,000 |
| 1867 | 300,000 |
| 1868 | 250,000 |
| 1869 | 200,000 |
| 1870 | 200,000 |

This was from the Forest Hill group alone, and does not include Bath district.

Since 1870 the yield has gradually decreased, and no accurate statistics are accessible. The bullion has been taken out by private conveyance of late years, and there is no record by Wells, Fargo & Co.'s express.

The ground is opened by means of tunnels, inclines (here called slopes), and shafts. Where there had been exposure from denudation the hydraulic process was adopted, as at Bath, Dardanells ground, below Forest City, and Todd's Valley on one rim, and on the other at the Mayflower and the heads of the various forks of the Brossby Cañon. These are undoubtedly side presentations of the channel. As the hydraulic washing progressed into the hill, the superincumbent volcanic matter became thicker and tunneling was resorted to; further hydraulic operations on the Middle Fork side, therefore, will not be profitable hereafter. Where there is no exposure the ground is opened by shafts. This method is uncertain and precarious, as the best may not be selected. The surface indications by which the miner is guided are not wholly reliable. There are usually "sags" or depressions in the surface of the ground which are supposed to indicate the line of the trough or gutter of the channel. In sinking inclines on the rim, there are frequently encountered masses of partially carbonized wood, beds of leaves, sand bars, &c., showing that at times there were great floods, followed by a sudden subsidence of the waters.

*Methods of working gravel.*—The treatment of the auriferous gravel depends upon its texture. Where the material is compact but not cemented it is readily treated by washing. The gravel is dumped into a shaped bin having a riffled gutter in the bottom. A stream of water is turned on from hose and pipe, and the gravel is run through several hundred feet of riffled sluices charged with quicksilver. The pipe has generally a 2-inch nozzle, and the water is projected under a head or pressure of from 50 to 100 feet. The sluices are usually from 18 to 20 inches deep, set on a grade of from 4 to 6 inches to the rod, sometimes less. The material passing over the sluices deposits itself in the cañon or natural outlet, and is sometimes washed again in a supplemental line of sluices. This material, called "tailings," readily slacks after exposure, and is sometimes washed a second and even a third time. This method is to be commended for its cheapness. The mine usually produces enough water for this method of treatment. Where the gravel is cemented it is necessary that it be crushed by stamps or kindred appliances. The Excelsior and Paragon claims each have a 10-stamp mill. The greater portion of the yield of the last claim is from their mill. The cost per car-load at the latter claim for milling and mining is nearly $4. This, however, includes the dead-work account. The metallurgical treatment is exceedingly simple. It is merely amalgamation in battery, supplemented by a short line of riffles.

At the Centennial mine, near Yankee Jim's, there is in use an ingenious device which takes the place of the stamp mill. The gravel is hoisted through an incline or slope 200 feet in length and dumped into a bin, whence it passes through an automatic feeder into a revolving cylinder of boiler iron, shod the long way with railroad track. The cylinder (which is an old boiler) is 20 feet long, 3 feet in diameter, set on a grade of 1 inch to its length. It runs on bearings in the manner of a B·uckner revolving furnace. The gravel in passing along its course falls about thirteen times. The result is that the gravel is broken and cleaned. To the lower end of the boiler is attached a flanged set of bars, revolving with it. The bars are 3 feet long and 1¼ inches apart. The material reaching this "grizzly," being effectually broken and cleaned, separates itself—the finer portions containing the pay dirt dropping into the feed-box of the crushing apparatus, while the coarser (pebbles and cobbles) are raked into a waste car. Thus the crusher (in this instance two Huntington batteries) has no superfluous work. The owners assure me that the machine would run thirty to thirty-five car-loads of 20 cubic feet per twelve hours, and that gravel paying $2 per car-load would pay expenses. The motive power was steam.

Very extensive drift mining operations are conducted higher up on the ridge at Sunnyside, Damascus, Murky Hill, Last Chance, and elsewhere, and within the past year many miles of ground have been located in this high region at the Hog's Back, New Basin, and Deep Cañon. This region has an elevation above sea-level of 6,000 feet, and is well watered and timbered, and the building of a "summer road" from the Summit Station of the Central Pacific Railroad is contemplated.

During the last year some 10 or 12 miles of locations have been made, but the season was too late to admit of a detailed examination.

*Placer and river mining.*—Of the California placer miners more than one-half are Chinese, who practice the business in all its branches and generally with a good degree of success, their patient, persistent methods of operating well adapting them for river-bed and similar kinds of mining in which they largely engage. Though prohibited by statute from mining on public domain and excluded from many districts by the local regulations, this people manage to circumvent the obstacles so sought to be interposed to their presence in the mines by the law-makers, national and local. The admission of these people to the mines in such numbers is objectionable in many respects. Their trade little benefits the whites, being confined mostly to their own countrymen. Their earnings are closely hoarded and nearly all remitted to China, while their methods of mining must, in certain localities, ultimately prove detrimental to that industry.

The placer mines of the southern counties of California have been regularly worked of late years, except when there was an insufficiency of water. In the winter season, when there is an abundance of water, the miners have learned lately to save the "float gold," a nearly impalpable dust which floats on the surface of the water. The method adopted is quite simple, consisting of a series of weirs placed across the stream, so that the water shall flow over each in succession. These weirs are constructed of piles and timber, with coarse gunny cloth covering the upper side. In the rainy season in a rich gold-bearing cañon what extra is saved by these weirs is estimated at from $10 to $30 per week, according to the richness of the dirt above and the number of weirs. In any case they are profitable, as their cost is small.

The placer mines of Southern California are but little known and are very remote from the central mining fields. In the absence of an opportunity for present inspection I present the following description from the Herald, a newspaper published at Los Angeles:

"Placer mining in Southern California has always been successful. The first gold discovered in the State having been found in Piru Cañon, Ventura County, by a Mexican, a few years before its discovery by Marshall at Coloma. We are now in receipt of late news in regard to more important placers. In the Soledad and Placer Cañons, above Newhall, the water is getting scarce; yet Mexicans, who are content with small returns, are packing the gold-bearing dirt to water and making fair wages. In the Sierra Pelon the water is sufficient to wash the richest dirt, the average soil being reserved for the rainy season. The San Gabriel still is the scene of great activity in both placer mining and developing the quartz mines. The water is abundant, and, as is well known, not only ordinary placer mining, but hydraulic mining is practiced. Millions of dollars of precious metals have been taken from these deposits as from the Piru, which is washed the entire year. This cañon comprises a portion of what is known as the Temescal ranch, and is a portion of the Camulous property.

"The Polomas Cañon, near by, is as rich as ever, but the claims are in the hands of a few men, who develop them simply according to their needs. The Tejon and San Francisquito Cañons, on either side of the

Mojave desert, have been gold-bearing for many years, but, on account of the difficulty of reaching them over the mountains and the lack of a base of supplies, the output is small, although a number of men are washing in each cañon the year round. The Castequi Cañon, west of Elizabeth Lake and north of the mountains, is quite profitable at any time, but is scarcely tributary to this county, as most of the output goes to Bakersfield, the most accessible town of importance. Besides these placers of importance, there are many which are worked by one or two prospectors and which have a slight yield individually, but which, in the aggregate, turn out a considerable amount of gold."

*Quartz mining.*—The business of quartz mining in California has recently undergone such improvement as will be likely to insure for it better results than has attended it in the past—silver mining promising at the same time to become soon an important factor in bullion production. The work of rehabilitating the old and partially deserted mines will go on and perhaps be accelerated. Some virgin ground will be opened and worked. The mills now running will be kept in operation; some will be enlarged and many new ones put up. With reduced expenditures there will come a closer working of ores growing out of some improvements in the mechanisms and some in the metallurgy of the business; and thus out of these gains there may be expected to arise a steady and long sustained increase of bullion production.

Gold-bearing quartz is now being profitably worked in California, yielding a total of not over $5 per ton; of this grade of quartz there are great quantities in California eligibly situated for treatment. Modern improvement and appliances have materially reduced the expenses of extracting and reducing gold ores. With a multiplicity of stamps, water-power, giant powder, power-drills, rock-breakers, self-feeders, concentrators, and the use of gravity in handling ores, low-grade ores can now be profitably reduced.

The cost of mining varies in different districts according to the condition of the mines, width of ledges, character of country, rock, &c. No two districts are precisely similar, but the rate of labor does not vary materially in California. I have selected the operations of a representative low-grade mine, to show the relative cost of different classes of work, trusting that the example will induce other miners to keep like accurate and systematic records for public information and benefit. I am prohibited from mentioning the name of the mine, and will merely say that the country rock is granite, the edge matter easily broken, the ledge of fair width, and the rates of labor $3 per day. Under these conditions the relative cost was as follows:

*Summary of operations of a representative low-grade quartz mine.*

STATEMENT OF COSTS.

| Items. | Cost. | Cost per foot. | Cost per ton. | Number of feet. | Number of tons. | Tons per foot. | Feet per ton. |
|---|---|---|---|---|---|---|---|
| Tunnel 7½ by 10, cross-cuts | $17, 419 22 | $19 77 | $3 31 | 881. 00 | 5, 264 | 5. 97 | 0. 167 |
| Levels 8 by 8, opened through tunnel .......... | 30, 472 88 | 13 61 | 2 80 | 22. 38 | 10, 915 | 4. 88 | 0. 205 |
| Winze 5 by 7½ .......... | 1, 254 52 | 17 92 | 6 15 | 70. 00 | 204 | 2. 91 | 0. 343 |
| Winze levels 8 by 6.......... | 347 68 | 14 48 | 3 86 | 24. 00 | 90 | 3. 75 | 0. 267 |
| Raises 5 by 6½.............. | 6, 213 90 | 7 40 | 2 95 | 8. 39 | 2, 112 | 2. 52 | 0. 397 |
| Cross-cuts 6 by 4½ in vein matter .................. | 4, 524 28 | 5 26 | 2 68 | 8. 60 | 1, 690 | 1. 96 | 0. 509 |
| Stopes .................. | 9, 588 36 | .......... | 2 36 | .......... | 4, 053 | .......... | .......... |

RATIO OF COSTS.

[Assume these items to cost 100.]

| Items. | Tunnel. | | Levels. | | Winze. | | Winze levels. | | Raises. | | Cross-cuts. | | Stopes. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Feet. | Tons. | Feet. | Tons. | Feet. | Tons. | Feet. | Tons. | Feet. | Tons. | Feet. | Tons. | Tons. |
| Tunnel | 100 | 100 | 69 | 85 | 91 | 106 | 73 | 117 | 37 | 89 | 27 | 81 | 71 |
| Levels | 146 | 118 | 100 | 100 | 132 | 220 | 107 | 138 | 54 | 105 | 37 | 95 | 84 |
| Winze | 110 | 54 | 76 | 46 | 100 | 100 | 81 | 63 | 41 | 48 | 29 | 44 | 38 |
| Winze levels | 137 | 86 | 94 | 72 | 124 | 159 | 100 | 100 | 51 | 76 | 36 | 69 | 61 |
| Raises | 267 | 112 | 184 | 95 | 242 | 209 | 196 | 131 | 100 | 100 | 71 | 91 | 80 |
| Cross-cuts | 376 | 124 | 259 | 105 | 341 | 229 | 257 | 144 | 141 | 110 | 100 | 100 | 88 |
| Stopes | ...... | 140 | ...... | 119 | .... | 261 | ....... | 164 | ...... | 125 | ...... | 114 | 100 |

My informant, in commenting on his record, says: "I have been surprised at the figures found in the ratio, and they are not such as are commonly accepted; for instance, if it costs 100 to stope, it only costs in tunnel, 140; levels, 119; winze, 261; winze levels, 164; raises, 125, and cross-cuts, 114. By guess, I should have said tunnel 400 at least."

There is really no standard line of demarkation between the classes of gold-bearing quartz known as "high grade" and "low grade." About ten years since all ores producing by milling process less than $10 per ton were classed as low grade, and no ore producing less than $20 per ton was regarded as "high grade." Now, ores producing $10 per ton are considered as high grade where water can be utilized as the motive power; and many ledges are yielding a handsome profit where formerly great losses were inevitable. This is due solely to the general adoption of labor-saving machinery and the introduction of water instead of steam. The relative cost of the two systems will appear in the returns of several leading companies from various portions of the State. In this State, particularly on the mother lode, the vein in places expands from 50 to 100 feet in width, or at least it is metal-bearing for that width, inclusive of the slates, giving an average value per ton of from $4 to $6. In many places it can be worked by open quarry to a considerable depth, and by adit level to a much greater depth. The great saving is in labor, as a large mill can be run at but little more expense than a small one.

A mine of this class well known to the writer has recently attracted much attention. It is situated in Tuolumne County, on the section of the mother lode beginning at Rawhide and running to the bank of Wood's Creek, below Jamestown. For several miles of the lode, the rock worked in bulk will yield in the mill from $3 to $6 per ton, and everywhere in this section it can be mined at an expense of $1 per ton.

One of the largest low-grade properties in the State is that of the Alabama mine, situated in the belt above referred to. Mr. Harris, the owner, on application, furnished the following details of his operations:

"*Record of the operations of the Alabama quartz mine of Tuolumne County, California*, 1883.

"*Mining.*—Employ three miners at $3 per day, and five surface-men at an average of $1.50 per day; cost of mining per ton, including dead work, 40 cents; average yield per ton, $3 to $3.50, containing also 1 per cent. sulphurets, which are not saved.

"*Milling.*—Forty stamps, run by water-power; weight of stamps, 750 pounds; 8-inch drop; 90 drops per minute. Cost of mill, $24,000. There are neither concentrators nor pans. Capacity per twenty-four hours, 80 tons. Cost of mill treatment, 70 cents per ton.

"The mine is worked by open cut and tunnels, without a shaft. The formation is mixed slate and quartz, and may be termed silicious slates.

It lies contiguous to the great mother lode (which is here compact white quartz) on the hanging wall, or eastern side. The greatest depth attained in the workings is 66 feet. The total cost of mining and milling is $1.10 per ton. This is without doubt the lowest record of profitable mining of low-grade ores presented in California.

"The mill was constructed with an especial view to saving all the labor possible. Nothing that can be done by machinery is done by hand. The power for the mill is furnished by a Knight water-wheel, which is run by water brought from the Tuolumne Water Company. Water costs $23 per day."

The Patterson mine, of Tuttletown, Tuolumne County, is on the mother lode. It is worked by shaft and has attained a depth of 500 feet. Under these conditions, by careful management and close treatment of the ores, it is realizing a handsome profit to its owners. Mr. W. F. Drake, the superintendent, furnished the statement of operations of the mine and mill. From an examination of his figures it will be observed that Mr. Drake has demonstrated that low-grade ores can be worked with profit by skillful metallurgical treatment. His views on the subject, recently published, are worthy of reproduction. In this connection, he says: "The best-regulated mills lose a great deal in this age of scientific advancement which should not be lost. Some mill-men advocate fine screens, say No. 60. My experience is that the loss is greater by reducing in stamp mortars the ore to such fineness, for the gold and mercury then become more floured, and pass off in the slimes, thereby increasing the loss, which no copper plates will catch, even if electro-plated with silver or gold.

"I have given practical attention to the reduction of gold ores for the past thirty years, and find myself following the old system, with very few improvements, but not as a matter of choice, it is so hard to introduce anything new, prejudice going always against one. I hardly dare to adopt a plan that is far surer and safer, because it would be at once considered a 'hobby.' So let us unite, exchange ideas, and see what can be done to lessen the evil. The matter must be faced, and I feel sure can be successfully combated. We have tried the old system long enough. Of course there are legions of patented mills, contractors, amalgamators, &c., but so far what do they amount to if there is no general system pronounced by trial of time, and in all conditions, to be perfect?

"My idea of the matter I will suggest in a few words. Crush your ore coarse enough not to bruise up your sulphurets too fine, so that they may be readily caught, say by a Frue concentrator, which is as good a machine as is made for my purpose. First of all, the most important point, do away entirely with stamp-mortar amalgamation. After the base metals have been saved by concentration, pass the residue through pans, and there amalgamate. I prefer my own pans, as they are self-discharging. They grind and amalgamate perfectly, and do not flour the mercury, reducing the pulp to thin paste. Then let the overflow of slimes pass into wooden settlers with revolving agitators; then, by careful manipulation, at least 90 per cent. will be saved. It is not too much, perhaps, for me to say that our mill is as perfect a gold-saver as the old appliances permit. From assays made I am not losing a very great percentage, but there is no reason why that loss may not be saved. I trust the remarks I have made will be taken up by others, and their opinions fully expressed with the one object in view of a common good. I have lately visited all the principal mills in Calaveras and Amador Counties, and failed to find anything but the old system in vogue."

By way of contrast, and with a view to showing the advantages of water-power and labor-saving machinery in the treatment of gold-bearing ores, the following is a statement made by Prof. B. Silliman, July, 1876, of the operations of the Rawhide mill, of 20 stamps, steam-power. The mill and mine is situated within 2 miles of the Alabama, and has not been worked since the period of his report:

MILLING COSTS—RAWHIDE MILLS, JULY, 1867.

| | | |
|---|---|---|
| Engine: | | |
| One engineer | $6 00 | |
| One engineer | 4 00 | |
| Four and one-half cords of wood, at $4 | 18 00 | |
| One fireman and helper | 2 50 | |
| Oil, &c | 50 | |
| | | $31 00 |

COST AND POWER.

| | | |
|---|---|---|
| Stamps: | | |
| One Manas rock-breaker | 2 75 | |
| Two battery-feeders, at $3 | 6 00 | |
| Hauling ore | 3 50 | |
| Shoes and dies | 3 00 | |
| | | 15 25 |
| Pans and amalgamators: | | |
| One amalgamator | 5 00 | |
| Two pan-men, at $3 | 6 00 | |
| Two tank-men, at $2.50 | 5 00 | |
| One assistant | 3 50 | |
| Quicksilver | 4 00 | |
| Lights, oils, chemicals, &c | 1 50 | |
| Wear and tear of shoes, dies, and pans | 7 00 | |
| | | 32 00 |
| Add sundry contingencies | | 1 75 |
| Total | | 80 00 |

Or at the rate of $2 per ton on a working capacity of 2 tons to stamp. With the addition of superintendence and extraordinary repairs, the cost would be at least $2.50 per ton.

The principal quartz-mining counties of California are Amador, Calaveras, El Dorado, Mono, Nevada, Placer, Plumas, Sierra, and Tuolumne. The number of mills in these counties will aggregate 150 and the number of stamps about 2,000—many of the mills having from 20 to 60 stamps, and a few as many as 80. While there are no complete statistics with regard to this branch of the mining industry, it will be safe to assume that 2,000 stamps, on an average, are daily engaged in crushing quartz. Allowing a capacity of 2 tons per day to the stamp, and an average run of 335 days to the year, the output of quartz would be about one and one-third million tons per annum, and this estimate would closely conform to the gold product usually credited to this industry; say five or six millions out of a total of eighteen millions, the balance being from hydraulic and other classes of mining.

The principal low-grade mines of the State are situated in the counties of Plumas and Sierra, and are owned in England. Through the courtesy of the resident manager, Mr. William Johns, I am enabled to present a statement of the cost of milling and mining of two mines, which have been profitably worked for nearly thirty years. This is preceded by the returns from a large low-grade mine in southern California. The Green Mountain, of Plumas, a notable low-grade mine of great value, failed to transmit returns.

The quartz mining districts of Auburn and Ophir are situated in the foot-hills of Placer County at an elevation of from 800 to 900 feet above sea-level. The controlling rock structure of the district is a belt of granite between belts of metamorphic slates. The ledges are, as a rule, narrow and rich. Quartz mining has been continuously prosecuted with varying but generally successful results since 1854. There are now about fifty producing mines in the two districts, employing nearly five hundred miners. Only a few of these locations, however, have attained depth below the water-line. Among the mines noted for their past record are the Crater, Saint Patrick, Peter Walter, Bellevue, and Green, most of which are still being worked. The greatest depth attained in these districts is less than 1,000 feet. Most of the operations are reasonably profitable, and the quartz industry has every prospect of permanence.

Grass Valley district is situated 26 miles due north of Auburn and Ophir. Quartz mining was commenced here as early as 1851, and still forms the principal occupation of the place. The records of the Allison Ranch, the Massachusetts Hill, North Star, and the Eureka mines are among the most noted of any in the State for production. It is claimed that the first quartz mill in the State was erected at the Allison Ranch mine on Wolf Creek. This distinction is, however, disputed by residents of Amador County, who allege that the first stamps dropped were on the Herbertville mine, near Amador City.

The mines of Grass Valley occur in various formations. The Allison Ranch was in granite, the Massachusetts Hill and North Star in slate, the Eureka in serpentine and slate. Of the principal producing mines now being worked, the Idaho, a cotinuation of the Eureka, is in the contact of slate and serpentine; the Empire and the Magenta in slate; the New York Hill in diorite. With the exception of the Idaho, all are narrow ledges, but are unusually rich, coming under the classification of "high grade." There are now in constant operation three custom and four company mills, aggregating 100 stamps.

The Idaho Company has, during the past year, at a large outlay, substituted water under pressure as a motive power instead of steam. For this purpose several miles of ditch were dug and 2 miles of No. 14 pipe, 32 inches in diameter, laid. The pipe is double riveted and lead jointed. They purchase 300 inches of water, at 16 cents per inch, deturred under a pressure of 550 feet. This power more than suffices to run their 50-stamp mill and all its accessories, machine-shops, &c., and also for the pumping and hoisting, which is done to a depth of 1,200 feet. The power is applied to the newly-invented telton wheel of the "hurdy-gurdy" class. They use six of these wheels, the largest having diameters of from 6 to 8 feet. These water-wheels have attracted special attention in the mining regions of this State, and are designed for small supplies of water where high heads can be attained. They are rapidly superseding the use of steam as a power. The change at the Idaho was made at an expense of $55,000, but it is believed that that amount will be saved in a two years' run. The annual statement of this company has been presented in detail in the preceding portion of the report under the head of California.

The year has been characterized by active prospecting and the reopening of some partially-developed mines. The western continuation of the Eureka, and the eastern continuation of the Idaho chutes, are being sought by prospecting shafts, with a reasonable showing of success.

Of the mines abandoned for several years the Albion Ranch and the North Star offer strong inducements for reopening. The Magenta, for some years shut down, has been reopened and several profitable crushings made. The shaft had, January 1, 1884, attained a depth of 400 feet, and the vein found strong, permanent, and rich.

Nevada mining district adjoins Grass Valley on the north. There is not, however, any similarity either in the rock structure or the ores of these districts. The principal mines of Nevada district are situated within the limits of a granite belt, or near the point of contact between granite and slate. The ores, as a rule, carry a greater proportion of sulphurets, and the mill treatment is consequently more expensive. The almost universal use of the improved concentrators and the introduction of chlorination works at the mines, as a part of the plant, has brought the working of hitherto so-called refractory ore to a high degree of perfection, and results of 80 per cent. of the assay value are now attainable. In harmony with this advance the cost of mining and milling has been greatly reduced by the adoption of water under pressure as a substitute for fuel and steam. The consequence is that this branch of mining is enjoying a career of unexampled prosperity. Quartz mining commenced here as early as 1850–'51, and continued until 1877, when it became nearly stagnant by reason of the failure of many so-called "processes," which were tried at great expense and all proved failures. The persistence and energy of the owners of one of the large mines, however, overcame all obstacles. A nearly perfect system of metallurgical treatment was finally evolved, and nearly all the abandoned mines were reopened and fitted out with water-power. At the present time there are twenty-five mines working below water-level, employing nearly five hundred miners. There are in operation ten company mills and three custom mills, aggregating 200 stamps. With only one exception, these mills are run by water-power under varying heads of pressure. The largest mine, the Providence, runs its hoisting and pumping works and its 40-stamp mill with 140 inches of water delivered under a pressure of 392 feet, at a cost of 16 cents per twenty-four hours. Under such conditions the cost of mining, pumping, and milling in the district for mines 500 feet in depth may be assumed to be $5 per ton; and this in most cases will include dead work. The cost of chlorination is included in the term "milling," where the company owns its own chlorination works. The cost of chlorination of the concentrated sulphurets is from $20 to $25 per ton at custom works, and at from $9 to $13 at company's works. This would be equivalent, in the latter case, to a cost per "rock ton" of from 33 to 40 cents, if based on the percentage of sulphurets usually found in the mines of this district. The practical working results of concentrated sulphurets in chlorination works, where there are facilities for leaching the silver from the chlorinated pulp, is from 88 to 90 per cent.

The following statement of expenses connected with the working of a mine with a 10-stamp mill—the whole plant being run by steam-power—is gleaned from the books of the Murchie Gold Mining Company, of the district:

ITEMS OF MINING EXPENSE—STEAM-POWER.

| | |
|---|---|
| Superintendence, including bookkeeping and assaying, per day | $12 00 |
| Mine foreman (for day time), per day | 4 00 |
| Mine foreman (for night time) | 4 00 |
| Blacksmith | 3 50 |
| Blacksmith helper | 1 50 |
| Engineer | 3 25 |
| Lander | 2 50 |
| Fireman | 2 00 |
| Mill expenses: | |
| Amalgamator, per day | 4 00 |
| Two millmen | 5 00 |
| One Chinaman | 1 50 |
| Screens | $0 80 |
| Quicksilver | 40 |
| Fuel, per cord | 3 50 |
| Powder, per pound | 23 |
| Candles, per pound | 18 |
| Steel, per pound | 14 |
| Iron, per pound | 4–5 |
| Fuse, per 100 feet | 67½ |
| Mine timbers (foot) | 05 |
| Lagging, 6 feet each | 05 |
| Poles, 6-inch, 20 feet | 1 00 |
| Oils, gallon | 1 00 |
| Charcoal, bushel | 12 |
| Steel-wire rope (foot) | 50 |

The cost of fuel and the necessary labor attending the use of steam-power at the above mine is $24.50 per day, the consumption of fuel averaging 200 cords per month. The segregated cost of milling is $1.50 per ton. But with water-power a saving of 75 cents per ton could be effected on a 40-stamp mill. The record would thus stand approximately:

| | |
|---|---|
| Mining, per ton | $3 50 |
| Milling, per ton | 75 |
| Chlorination of ore, per ton (rock broken from the mine) | 35 |
| Estimate dead work to ton of ore | 40 |
| Total | 5 00 |

The capacity of a 40-stamp mill may be estimated at 28,000 tons per annum.

Nevada district having reserves of $10 ore, the outlook for the future is promising.

The metallurgical treatment of ores in Nevada district does not naturally differ in the various mines. The works of the Providence Mining Company approach as near perfection in efficiency and economy as any plant in California. This mine has a length of 7,000 feet and is worked through three shafts. The drain tunnel is now 4,000 feet in length and the deepest working of the mine by incline shaft 1,100 feet. The hoisting, pumping, and milling is done by water-power, the company using 140 inches (miner's measurement), under a pressure or head of 392 feet, for which they pay 16 cents per inch. This would be equivalent to 330,400 cubic feet, or about 2,500,000 gallons per twenty-four hours. The total cost for power is therefore $32 to $40 per day. The ore is landed on the mill floor, where it passes through the rock breakers and drops to the feed platform. Here it passes to the batteries, thence (after amalgamation in battery) over silver electro-plated sluices to the Frue vanners, of which there are sixteen, or four to each battery of 10 stamps. The product of the Frue concentrators goes to the drying floor and thence to the roasting furnaces. These are circular and constructed with three floors, the ore dropping from floor to floor at the proper stage of roasting. There are two furnaces with a capacity of 3 tons each per twenty-four hours, then follows the chlorination vats, eight in number; and finally the leaching tubs for the extraction of the silver. The total drop from the rock-breaker floor to the leaching floor is 120 feet.

This system, though not absolutely perfect, is the best that has been devised for this class of ores. No measures have been taken for the treatment of tailings, but the owners of the property have liberally afforded every opportunity to the numerous experimenters in the line of utilizing tailings, but so far without mutual profit.

The Providence mine is prolific in many grades of ore, and its annual product may be gauged by the owners according to their necessities. They have large bodies of low-grade ore which afford a fair profit at $7 per ton, and choice spots containing telluride ores averaging $1 per pound. Also masses of heavy sulphureted ore averaging from $50 to $100 per ton. This latter class of ores is treated separately by crushing through a seggregated battery, without concentration, settling the residue in a tank and mixing it with the concentrators of the Frue vanners, with which it is merged in the treatment by chlorination.

Amador County still maintains its prominence as the second mining county of the State. The companies operating in that county are close corporations, and rarely make public the details of their business. The principal mines are on the line of the mother lode. The ore is not of high grade, rarely exceeding $10 per ton, but the mines are generally worked with profit. Among the prominent mines are the Keystone, Empire, and Pacific. The latter company is a large producer. The mill of 60 stamps is considered a model one for effectiveness and economy. When Prof. Thomas Price was appointed purchasing agent for the great mining company at Transvaal, in South Africa, he examined several mills in this State, and, after comparison, he decided to build a duplicate of the Pacific mill.

The details of the operations of Bodie district will be found elsewhere in this report under the head of "California."

*Silver mining.*—The silver-bearing lodes discovered not long since in the Calico and districts adjacent and in San Bernardino County have been actively worked during the past year, and generally with favorable results. This work has, however, except in few instances, been confined to the removal of ore lying near the surface; not many companies have as yet opened their mines to any great depth. The ore extracted mostly a chloride, carrying sometimes a horn-silver, is of good grade, assaying from $50 to $500 per ton, the bulk of that worked having yielded under mill process over $100 per ton. The consequence was that last year's product considerably increased the output of silver, and these mines will be likely to add materially to the product of that metal in California hereafter. An increased output of silver may also be looked for in Inyo, Mono, and Alpine Counties, in many parts of which the argentiferous ores abound. Valuable deposits of this ore are also reported in Shasta County and elsewhere in the State, California resources in this respect being considerable. The silver output for the past ten years has ranged from $1,000,000 to $10,000,000 per annum. It fell off after the suspension of the base-metal mines in Inyo County, and is now on the increase from discoveries of chloride ores in the desert country between the Mojave and Colorado Rivers. The principal mines of that region are the Bonanza King, the Silver King, the Porter and Waterman, and the Daggett group, all lying in proximity to railroads recently constructed and opened.

The Providence Mountain, lying about 30 miles west of the Colorado River, and about the same distance north of the Atlantic and Pacific Railroad, contains several districts of silver-bearing ores. New York district was located at an early period and the mines worked on a small scale by the primitive Mexican system of arrastra. Only the first-class or selected ores are treated, the second grade being reserved for future mill treatment. The ores are mostly chlorides and yield a high percentage by the sulphuret process. The great difficulty of the district has heretofore been a scarcity of water.

The Bonanza King mine is situated near the highest peak of the Providence Range. The formation is on the line of limestone and porphyry, probably a contact vein. The ores are chlorides and sulphurets of free character, being worked to 89 per cent. by the process of dry crushing and pan amalgamation with chemicals. The mill has 10 stamps and 6 pans. The following is a summary of its operations:

| | |
|---|---|
| Yield for 1883, 317 days, $573,474.85, or per ton | $180 00 |
| Cost of mining, including dead work and sinking of main working shaft, per ton | $16 00 |
| Hauling 2 miles, per ton | $2 00 |
| Cost of milling, per ton | $7 70 |
| Ore worked, tons | 7,100 |
| Bullion, fineness | 900 |
| Percentage saved | 89 |
| Tailings assay, per ton | $13 00 |
| Average yield, per ton | $179 00 |

The Bonanza King has attained a depth of 520 feet without encountering water. The greatest length of horizontal exploration is about 100 feet.

The ores of Calico district as a rule lie near the surface and are cheaply mined. The cost of mining and hauling to mill at Waterman and Porter does not exceed $1.50 per ton. This mine is situated in Grape Vine District, San Bernardino County. The ores are sulphides and chlorides. It is equipped with a 10-stamp mill, having a capacity of 35 tons per day. The following is a summary of milling expense per day:

| | | | |
|---|---|---|---|
| 2 feeders, at $4 | $8 | 1 superintendent | $8 |
| 2 amalgators, at $4 | 8 | 2 extra men, at $3 | 6 |
| 2 tank-men, at $3 | 6 | Oil and lights | 5 |
| 2 engineers, at $4 | 8 | Loss of quicksilver | 13 |
| 2 firemen, at $3 | 6 | Chemicals (copper salt, &c.) | 35 |
| 1 blacksmith | 4 | Wear and tear and repair of machinery | 23 |
| 1 screen-man | 3 | | |
| 2 dump-men, at $3 | 6 | | |
| 6 cords wood, at $6 | 36 | Total | 175 |

Or at an average rate of $5 per ton. Where self-feeders are used the cost is reduced, but $5 may be accepted as a general average on this class of ores. The conditions at other mines of the country between the Mojave and Colorado do not materially differ.

## *DRIFT MINING OF CALIFORNIA.*

By R. L. Dunn, M. E.

Out of the peculiar conditions of situation of the auriferous gravels of California has been developed the method of mining generally termed "drift mining." Owing probably to its exclusive localization in California, and its comparatively slow development as one of the leading branches of the gold-mining industry of the State, is due the absence of much definite published information concerning the practical detail of its operation. Also has it been to a less extent than any other branch of mining the subject of study and scientific investigation by trained mining engineers. The practically complete cessation of hydraulic mining resulting from the adverse decision of the courts in the "*Débris* suits," has brought drift mining more prominently into attention and consideration by gravel-mine owners, as being the only possible method by which to work their claims. Many extensive and important mines are now being operated by its methods, and a great extension of the industry is promised in the immediate future by the opening and development of as yet untouched ground. In this article I have taken the experience of the practical working of many of the old and successfully operated mines, and from it have made such general deductions as will be of assistance in the exploration and development of new claims.

The drift-mining districts of California comprise practically the entire areas in the State containing the unworked-out gold placers, and are part of the western slope of the Sierras included within the counties from Mariposa on the south, Shasta and Siskiyou on the north. It is in Nevada, Placer, and Sierra Counties that the most extensive areas of mining ground are found, and also the, at present, most important mines being worked. Plumas, Butte, El Dorado, Amador, Calaveras, and Tuolumne Counties have also considerable areas of mining ground and important mines.

The geological character of this entire district is uniform through its entire extent. The main axis of the Sierras and including the western slope to a distance from 10 to 30 miles from the summit is granite. From the western edge of the granite and overlying it from thence, and extending to and disappearing under the alluvial plains of the valley, is an immense body of metamorphic stratified rocks. Of these slate forms by far the larger part, limestone being the next most important. In a large area of Western Placer, Nevada, and El Dorado Counties granite appears at the surface and is the country rock. The age of the slates and limestones, so far as determination has been made from the rare fossils found, seems to be Jurassic and Triassic. In the granite and slate in the vicinity of the line of separation of the two formations, and in the slates in certain defined belts are large numbers of auriferous quartz veins constituting the present quartz mines of the State, and by their erosion in the geological epochs the source of the gold found in the placers. This erosion, or rather the first of the two or three erosions this country has been subjected to, occurred in the Tertiary era extending into if not through the Pliocene period. The evidence of this erosion consists of fragments of the old river channels of that time, which will be more particularly described further on. The general topography of the country must have been rough, but hilly rather than mountainous. The river depressions do not seem to have been deep precipitous gorges and cañons, as at present, but apparently the streams run in beds very near the general level of the country. These ancient rivers were, judging from the disconnected fragments of their channels that have been explored in mining, comparatively short streams, but in some instances of great width and carrying large bodies of water.

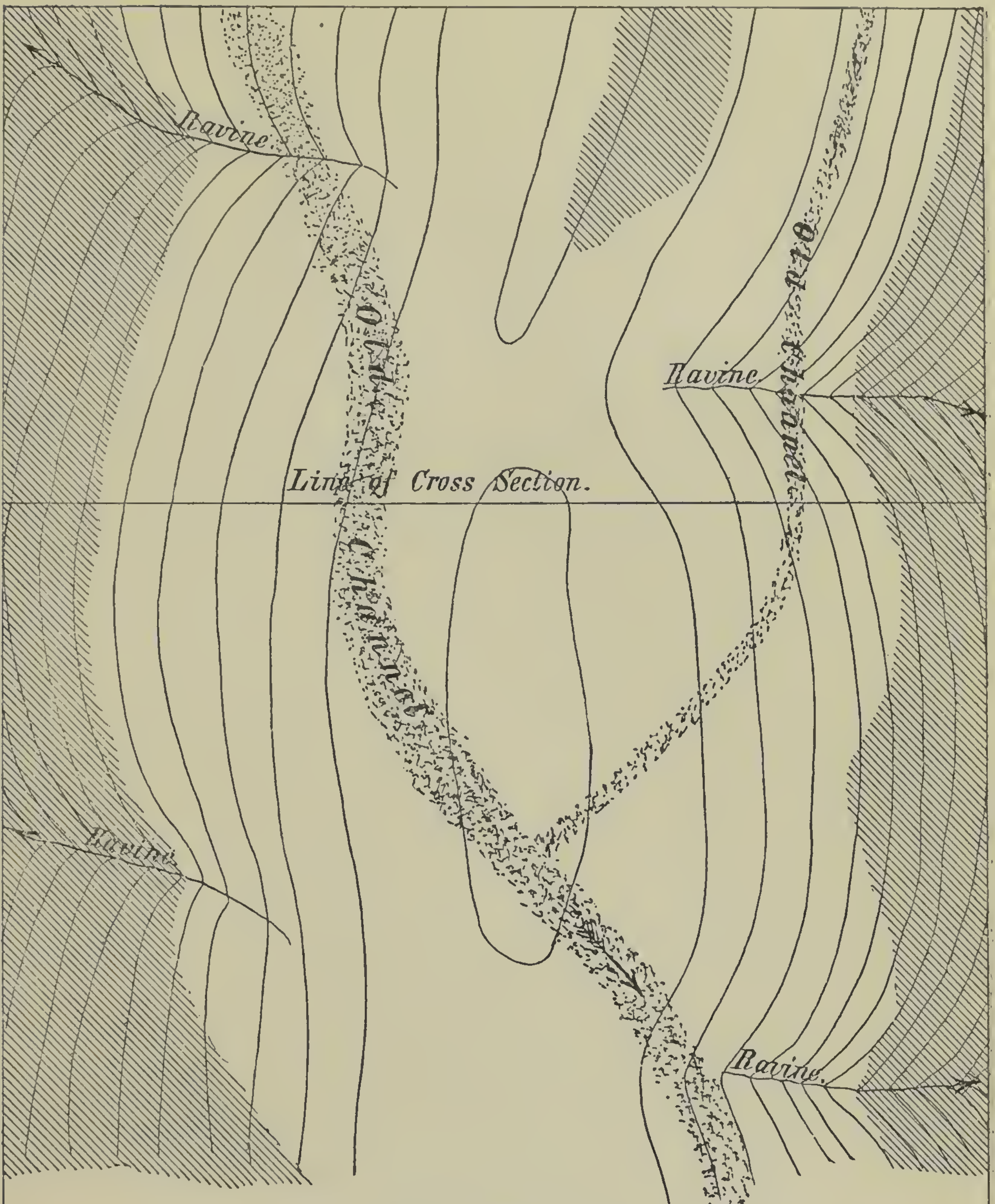
In some localities two distinct sets of ancient river channels have been found, one cutting across the other, and so differing in every essential characteristic that they were undoubtedly formed during widely separated periods of time. All of these old stream channels necessarily became more or less filled with the detritus of their erosion. In some the *débris* consists almost exclusively of quartz, bowlders, gravel, and sand; others, again, are marked by almost an entire absence of quartz, its place being taken by granite, slate, and lava, gravels, sands, and clays. In nearly all of these gravel-filled channels was gold, gathered from the eroded auriferous quartz veins and seams. This, briefly stated, was the physical condition of this country during the Pliocene period and until a great lava flow swept over the surface and covered it from one or two hundred to as many thousand feet deep. This lava flow followed and became, of course, deepest in the channel depressions, but was still deep enough to cover nearly all the elevations as well. It closed the period of the old physical conditions and topography of the country and was the commencement from which this present topography dates. The present streams, principal among which, as draining the largest and most important part of the mining area, are the Feather, Yuba, and American, with their respective forks and branches, have gradually eroded tremendous cañons, in which they run one, two, and even three thousand feet below the summits of their precipitous sides. Their general course, more particularly in the region of the lava-covered old river channels, is, if anything, more westerly than the latter, though this is by no means invariable, the direct reverse of this being true in some localities and in others the courses being parallel. The erosion cut away first the lava, then the gravel drift in the buried channels, and finally far into the hard slates. The gold eroded out of the old channels, and some from the direct erosion of quartz veins, enriched the ravines, river beds, and bars, making the rich placers from which immense sums were taken during the early years of the California gold mining. These were long since practically exhausted and abandoned, and the source of the placer gold at present being taken out and still valuable for the mining of future years, is to be found in the fragments of the old river channels and drift left by the erosion of the present rivers lava-buried in the high divides or mountain spurs between the extremes. These divides are from a few hundred yards to several miles in width, comparatively level, except for a light upward grade toward the main mountain axis. The small tributaries of the rivers run on these divides in shallow depressions on easy grades until they reach the precipitous cañon sides down which they plunge in cascades and waterfalls.

The genesis and history of the deep placers, as they are sometimes termed, have been given in this article at considerable length, as in them are much general data that can be practically applied in mining them. The original discovery of the deep placers of the ancient river system occurred in the working of the ravines and gulches by the early miners.

They kept prospecting and working up higher on the mountain sides in search of the source of the gold and finally reached points beyond which it was impossible to find any traces of it on the surface. At these points they found the auriferous gravel going into the mountain, and by means of short tunnels run following the pay (as it is termed) on the surface of the bed-rock, they mined it. It was, however, soon discovered that in going into the mountain the bed-rock instead of rising, that is keeping on an ascending grade, pitched away from the face of the mountain, that is on a descending grade inward, and as a consequence the influx of water into the working having no natural drainage, soon become too large to admit of economical handling. Accordingly, to afford natural drainage and also to secure easier carriage for the gravel from the mine to the surface where it was washed, tunnels were run in the bed-rock on a light ascending grade and at such depths as was supposed would leave it lower than the lowest point it was designed to work. From this time drift mining became recognized as a distinct branch of placer-mining. A more correct and extensive knowledge has gradually been acquired of the locus and peculiarities of the placers worked by its methods, though such is the conservatism of the miners of many of the districts that the results of experience are ignored in favor of the crude theories and methods of the earliest drift mining. The average drift miner who has been at it for twenty-five or thirty years in one locality is full of theories regarding the character and location of the channels. So much like the operation of chance has been the discovery of many of the richest mines, that the miners are always hoping to make a lucky strike and, looking at that, in many instances color their opinions by their wishes. As a result, in many instances of this blind dependence on chance for success in discovering a rich claim, hundred of tunnels and shafts have been made which proved a complete failure, and probably more money has been needlessly sunk than in quartz mining in the State.

The annexed diagram is intended to represent typically a portion of one of the lava-capped divides containing an old river channel, as illustrating the methods of prospecting and mining. Surface indications of the presence of an old channel are not always to be found. In case the channel runs directly or diagonally through the divide or mountain spur, at the points of ingress and egress gravel rich in gold is often found in large quantities, and this, with other indications in connection with it, is considered conclusive evidence as to the locus of the channel. More often, however, as in the case with the two channels indicated in the diagram, they run with the divide, and with entrances so far removed from the ground under examination that they cannot be identified as connected with it, and would be useless if they could, in which instances there is no absolutely direct evidence of the existence of a channel, and it for the time being must be regarded as suppositious or reasonable from analogy. Often these latter-described channels are located so close to the front of the mountain that the ravines and gulches, while not cutting through them, have eroded so close as to remove some of the gravel and present the indications of a channel entrance. Some of the richest drift mines in the State have been located by tracing up these "break-outs," as they are termed.

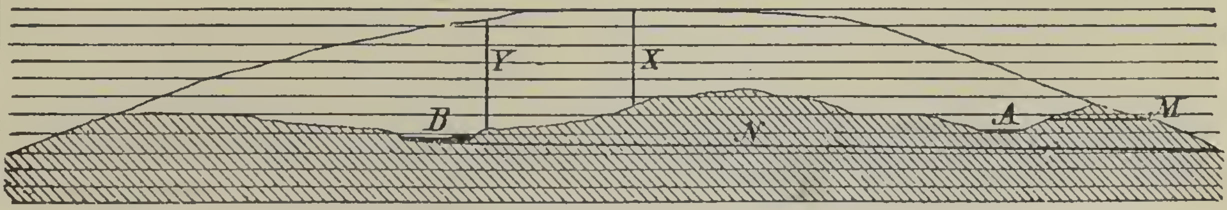
If the surface of one of these divides be examined carefully, and surveyed and platted, showing the true contours and line of junction of the bed-rock and lava (or, as it is locally called, cement), it will in its general features resemble the annexed diagram. It will be observed that the surface line of junction of the two formations does not align



Scale, 800 feet to 1 inch.

Diagram of horizontal projection of lava covered "Old Channels," showing contour lines of surface.

Shaded ground represents contours of "bed rock," or country rock. Unshaded ground, lava. Vertical distance between contour planes, 50 feet-



Profile Line of Cross Section.

Shaded ground — bed rock. Unshaded — lava. A B — beds of Old River Channels.
M N — tunnels. X Y — shafts.
Vertical scale, 800 feet to 1 inch.

with contour lines on the surface, but shows considerable variations in relative altitude at different points, and it is this fact that makes it possible to approximate to the varying locus of the hidden channel, other conditions dependent on ascertainable data being favorable. The high bed rock lying between the channel and the face of the hill on both sides is commonly referred to as being the "rims" or "rim rock" of the channel. Two channels in the same divide, which are of frequent occurrence, each having only the outer rim visible at the surface, complicates considerably the solution of the problem referred to above, and the approximate determination of the locus of the buried channel by engineering methods alone, and will often render it impossible. Considering the case delineated by the diagram, suppose a number of cross-sections be made in lines parallel to the line marked "line of cross-section," at supposed right angles to the line of the channel sought for, and at, say, 250 feet apart. In each of these that would cross the upper portion of the diagram, where in each of the channels both rims come to the surface, there would be given the horizontal distance between the point of intersection of the rims with the surface and their difference of level. With two more conditions given, the slope of the rims forward, and the width of the channels, its location in that particular section line could be exactly determined. As to the mean slope angle of the rims, it must be so taken for trial that on applying it in calculation it will locate the channel depression symmetrically between the rims. It is a matter of judgment of the engineer with reference to the ground that is being examined, and it is advisable to try maximum and minimum limits. The probable width of the channel can only be guessed to its most probable figure. A knowledge of the known channels of the locality is the safest guide. The highest maximum of mean slope should not exceed 30°, and for width of channel not over 500 feet. Now, with the data already discussed, the horizontal distance from the surface point of the upper rim to the approximate center of the channel will be equal to one-half the distance from the first-named point to the point in its plane at which the mean slope line passing through the lower rim surface point would strike, the slope angle being the same for both rims, and the difference of level between the plane of the upper rim point and the depression of the channel equal to the half distance referred to above into the tangent of the slope angle, diminished by one-half the assumed width of the channel into the tangent of the slope angle. The graphical method is best suited for obtaining these quantities, no great degree of accuracy being required. The same rules being applied to the other cross-sections, a series of line and grade points wil lhave been obtained, and by comparison an average can be obtained which will check out unconformable extremes, and will also determine points where only one rim is available, as is the case illustrated on the diagram. Having platted the presumed course and grade of the channel on the topographical map, the engineer can readily determine the points from which the channel can be prospected most thoroughly and economically, and, if found to contain enough gold to pay for opening and working, the best available point for that purpose, making use of the additional and exact data acquired in the prospecting.

It will at first consideration seem that, using such inconstant factors and unknown variables as can only be had under the circumstances, it would be impossible to place any reliance on the results so obtained. Such, however, is not found to be the case in practice. The limits for error are usually easily determined, and it is very rarely that an extreme case similar to the hypothetical one considered in this article will occur. More or less underground work can be used to correct the theoretical determinations, and connections can be made with the underground works of adjoining claims that can be proven to be on the same channel, mean slope of rims, grade, and relative elevation of channel and surface.

The prospecting of the deep placers is done through small tunnels and drifts, either from the face of the mountain, or, where the overlying deposit is not too deep, from the bottom of small prospecting shafts. Unless there is considerable water requiring to be handled, the latter are preferable, both as being more economical and testing a more extended area in the same length of time. Bore holes sunk where the depth to bed rock is too great for prospect shafts are also employed successfully.

The permanent working of a drift mine is, wherever practicable, by means of tunnel, coming out of the mine from its lowest workings on a slight descending grade, as being by far the most economical. In some mines it has been found advisable to operate through a shaft, but it is very costly to do so. So many different factors control the expense of mining the gravel, and at some mines the milling of it also, by reason of being cemented, that no general rule can be given. At some favored mines the cost is only $40 to $60 a 2-ton car-load; in other mines it is from $400 to $600 and even higher for the same quantity.

The cost of opening a large drift mine and fitting it up for active operation is necessarily very large, and requires time. The main tunnel has often to be run 2,000 or 3,000 feet in hard bed rock before the pay gravel is reached. Too much attention cannot be given to the proper location of this main tunnel where of unavoidably great length. One hundred feet in length saved represents a large saving in cost. In this work trained engineering skill should be employed. Though the service seems costly, yet properly applied it is in the outcome a great economy. Even the saving of a dollar a foot amounts to a large sum in the aggregate, and a saving of $5 a foot is often possible by changing the line of the tunnel 10 feet to one side or the other.

If, on the one side, the expenses and risks of drift mining are large, so also are the returns of its successful operation liable to be very large. The gold yield of these deep placers is sometimes enormous. Single car-loads of gravel have been taken out that paid $11,000. Out of a half acre of ground in one mine $800,000 was taken out. Mines that have yielded bars are common, and yet, beyond all question, not one-sixth of the area that can be worked profitably has been touched with a pick. The opportunity for investment of capital in and development of drift mines has never been as good as at present.

# *ON THE PROGRESS WHICH HAS BEEN MADE IN THE CONSTRUCTION OF DRY-CRUSHING SILVER MILLS, AND IN THE TREATMENT OF SO-CALLED DRY AND BASE SILVER ORES, IN THE WEST OF THE UNITED STATES.*

By C. A. Stetefeldt.

It is not intended, in this paper, to treat the above subject in an exhaustive manner, but only to point out, in a general way, what progress has been made, and to call attention to recent improvements which eventually must create a revolution in this special branch of metallurgy.

The distinctively American dry-crushing silver mill came into existence about the year 1865, after the discovery of the Reese River mines in Nevada. What had been done previously on the Comstock was simply to copy the Freiberg barrel amalgamation. The substitution of the pan for the barrel forms the real starting point of deviation from old methods. In discussing the progressive steps taken in the construction of dry-crushing silver mills I will consider each one of the different parts of the plant by itself.

1. *Breaking of the ore as it comes from the mine.*—Blake's crusher, first introduced for breaking ore in silver mills in Colorado in 1864, and since then in use all over the civilized world, marks the adoption of a principle for breaking ore which, in its application, is so simple, effective, and economical that I doubt if it will ever be superseded by any other. The idea has been taken up by many other inventors, and whatever the merits of their improvements may be, they have not achieved any important results which call for special commendation. Even in those crushers in which the jaws have received a circular form the acting principle is essentially the same.

2. *Drying of the crushed ore.*—The old-fashioned dry-kiln, consisting of heated flues covered with iron plates, has almost completely disappeared, at least in most mills of more recent construction. It has been replaced by the revolving dry-kiln, first introduced about 1875, where I have not been able to ascertain. There is not only much labor and fuel saved, but the moisture is more completely removed, which is essential for dry-crushing, and the annoyance of a hot floor, so unhealthy to the laborer, is avoided. A new style of drier, the shelf dry-kiln, first built at the Lexington mill, Montana, in 1882, is rapidly gaining favor. Its mode of working being automatic, by gravitation, it dispenses with power. It also does away with dust-chambers, and occupies less space for equal capacity than the revolving dry-kiln.

3. *The crushing of the dry ore.*—In the dry crushing of ores progress has been very slow until of late, in spite of the numerous efforts made in this direction. A few years ago the idea prevailed with all experienced millwrights that the California stamp-battery would keep the field as the only suitable apparatus for producing fine pulp. This assumption was based upon the fact that all machines the construction

of which had been based upon other principles failed to accomplish what was claimed for them. Hence all efforts were directed to make the stamp-battery as effective and durable as possible. The increase in weight of the stamps, the increased number of drops, changes in the shape of cams and mortars, the introduction of cast-steel shoes and dies, and of self-feeders, and also of improved guides, were the principal points elaborated, without, however, producing any very marked results. The stamp-battery still remains the most troublesome part of the mill plant. It is true the battery of to-day is far superior to that of twenty years ago, not only in efficiency and durability, but in auxiliary appointments. The dusty chamber in front of the battery, where the pulp accumulated, and which had to be entered by a laborer to load a car, has given way to elegant conveyors and elevators, which remove the pulp continuously and take it to the roasting furnaces. Dust-chambers now connect with the battery-housing, into which the dust, formerly escaping from every opening and settling upon machinery, is drawn by a suction-fan, to be regained, and finally mixed with the pulp before it enters the roasting furnaces. Machinery has also been perfected for the separate crushing and feeding of the salt, this being of advantage in some respects.

The first decisive departure in pulverizing ores dry was made by the introduction of Krom's rolls at the Bertrand mill, Nevada, in 1882. While rolls had been generally used for pulverizing ores for the purpose of concentration, it remained for Mr. Krom to construct rolls suitable for producing pulp for subsequent treatment by roasting and amalgamation or lixiviation. By providing the rolls with steel tires, running them at the high speed of 100 revolutions per minute, with pulleys only, and constructing them in a most substantial manner generally, he succeeded where others had failed. Leaving, for the moment, the purely economical question out of view, I will consider the physical difference which exists between pulp produced by each of the two machines. If pulp produced by rolls, or by stamps, is sifted through the same size of screen, the ore particles from the former are more uniform in size than those from the latter. The pulp from the rolls contains much less of such fine material which will pass, say, through a No. 100 wire screen, down to impalpable dust. Based upon experience in raw amalgamation, it was formerly assumed that the production of an impalpable powder was essential to success, even in case the ore had to be roasted before amalgamation. Hence it was the general practice to crush through a No. 80 or No. 60 screen in the older mills of Nevada. While this practice was gradually abandoned, and crushing through No. 40, and finally No. 30, screen was in most mills adopted, the subject was never fully investigated until recently. It has been found that for chloridizing roasting great fineness of the ore is entirely unnecessary, and that it is actually injurious in the amalgamation of roasted silver ores. Of course, the character of the ore has always to be taken into consideration. In the lixiviation process a large percentage of fine material interferes seriously with rapid filtration, and unnecessarily lengthens the time of working a charge. From this it follows that ore pulverized by rolls is mechanically in a more favorable condition than if stamps have been used.

I turn now to the question of economy. A discussion of the subject which is complete and thorough, and compares the efficiency of rolls and stamps under varying conditions, is not possible at present, because the available statistics concerning rolls are confined to those from the Bertrand mill, Nevada. Prior to the introduction of Krom's rolls in this mill they were used in works only erected for the concentration of ores by Krom's dry system. Sufficient evidence, however, has accumulated to prove the superiority of the rolls beyond any doubt. Their introduction at the Mount Cory mill, Nevada, will soon bring additional proof. It seems to me that the application of rolls is most favorable in such cases in which the silver is extracted by lixiviation and the character of the ore permits comparatively coarse crushing without interfering with good roasting.

A comparison between rolls and stamps will be made from the following premises, for the correctness of which I must ask the indulgence of the reader. I assume that the crushing capacity of two sets of Krom's 26-inch rolls is equal to that of a 30 stamp battery with stamps of 850 pounds dropping from 7 inches to 8 inches 94 times per minute. Mr. Clark, superintendent of the Bertrand mill, states that he can crush, with two sets of rolls, 100 tons of ore in 24 hours to such a fineness that all will pass through a No. 16 screen, consuming not over 4 cords of wood for power. The ore has a quartz gangue and is by no means an easy crushing ore. The fuel required for running 30 stamps would be about 6 cords of wood in 24 hours, taking into consideration the construction of engine and boilers, and quality of wood. For some remote locality in the West the following prices are assumed, namely: Freight at 3 cents per pound; lumber at $50 per thousand feet; wood at $6 per cord; wages of carpenters at $4.50 per diem, and of millwrights at $6. Certain items of construction will be about equal, namely: Conveyors, elevators, revolving screens, and dust-chambers. Revolving screens are also used in connection with a well-appointed battery in order to separate coarse material resulting from a breakage of battery screens. The building, however, for rolls will be much smaller than that for the battery, and a saving of not less than $1,500 will be effected in its construction. Finally, the rolls requiring less power, a saving of at least $1,250 will be made in providing and setting up engine and boilers in a mill with rolls.

*Cost of erecting a 30 stamp battery.*—The plant, including hard-wood screen frames and guides, wooden pulleys on cam-shafts, Tulloch's feeders, and all necessary bolts, weighs 90,600 pounds, and costs in Chicago $5,850, according to a statement from Messrs. Fraser & Chalmers. The framework takes about 36,000 feet of lumber, and the expense of setting up the battery is estimated at $4,000. Hence the total cost of constructing a 30-stamp battery is:

| | |
|---|---|
| Plant at foundry | $5,850 |
| Freight | 2,718 |
| Lumber | 1,800 |
| Cost of setting up | 4,000 |
| Total | 14,368 |

To this has to be added, in order to compare with rolls:

| | |
|---|---|
| Extra cost of building | 1,500 |
| Extra cost of engine and boilers | 1,250 |
| Total | 17,118 |

*Cost of erecting two sets of Krom's 26-inch rolls.*—The amount of lumber required for setting up the rolls alone is merely nominal. From this it follows also that the labor of placing the rolls must be trifling. The weight of one set of 26-inch rolls is 12,000 pounds, and the cost in New York, $2,250. There is one self-feeder required, and its weight is estimated at 2,000 pounds; cost at $200. From these figures I deduce the following:

| | |
|---|---|
| Plant at foundry | $4,700 |
| Freight | 780 |
| Cost of setting up | 700 |
| Total | 6,180 |

Difference in favor of rolls, $10,938.

*Wear and tear of stamps and rolls.*—In comparing the wear and tear of stamps and rolls we cannot very well express this item per ton of ore crushed, because the capacity of the pulverizing machinery is a function of the hardness of the ore and of the fineness of the pulp produced. A more correct method will be to take figures per running time of 24 hours. Making estimates from this standpoint, it is supposed that the wear and tear in running the machinery at full capacity is a nearly constant quantity, while the capacity is variable, as stated above. The wear of rolls is principally confined to the steel tires; that of the battery to a great number of parts. With rolls the steel tires can be consumed to within less than one-half inch of their thickness, while with stamps the shoes and dies have to be exchanged after only two-thirds, or less, of their weight has been worn, leaving other parts out of consideration. Another point should not be overlooked. The complicated construction of the battery causes considerable expense in skilled labor for repairs, which in the case of rolls is merely nominal. Advocates of the battery have argued that its great advantage is the continuance of its operation if one battery of 5 stamps gets out of order, while both sets of rolls, or three sets, as the case may be, have to be stopped if repairs are needed for one set. But it is just the solid construction of Krom's rolls which reduces stoppages from this cause to a minimum. How often it is necessary to hang up stamps for repairs is too well known to require any statistical proof.

*Wear and tear of Krom's rolls.*—As to statistics of wear and tear of Krom's rolls, I am confined at present to those from the Bertrand mill. Mr. R. D. Clark states that two sets of steel tires have been worn out in crushing, in round figures, 20,000 tons of ore. As stated previously, the full capacity of the rolls is in 24 hours 100 tons, the ore being sifted through a No. 16 screen. In the beginning, however, the ore was crushed much finer, namely, so as to pass a No. 20 screen, and the daily capacity of the rolls was much less. Taking this into consideration, the actual wearing capacity of the tires cannot be estimated at less than 250 working days. The cost of this wear is as follows: Two sets of steel tires cost at New York $764, their weight being 3,264 pounds. With freight at 3 cents, the total cost of these steel tires is $862.

| | |
|---|---|
| Wear and tear of steel tires in 24 hours | $3 45 |
| Wear of other parts, screens, lubricants, and supplies | 1 75 |
| Wages for repairs | 1 25 |
| Total | 6 45 |

*Wear and tear of stamps.*—I have been favored with statistics from three of the most prominent mills in the West, namely, the Manhattan, Nevada; the Ontario, Utah; and the Lexington, Montana. Taking into consideration the somewhat abnormal conditions of the Manhattan mill in so far as the weight of stamps there is 1,000 pounds, and the number of drops per minute greater than in either of the other mills, and that the statistics from the Lexington are those from the first year's run, where certain breakages are reduced to a minimum; finally, that freight in these localities, on account of direct railroad communications, is less than I have assumed in my premises, I arrive, by making such allowances, at the following figures for wear and tear of a 30-stamp battery per 24 hours running time:

| | |
|---|---|
| Cost of all parts subjected to wear and breakage, screens, supplies, and lubricants | $11 50 |
| Wages for repairs | 5 50 |
| Total | 17 00 |
| Wear and tear of rolls | 6 45 |
| Difference in favor of rolls | 10 55 |

*Interest and amortization.*—In comparing the expense of running rolls and stamps interest and amortization on the excess of capital required in the original construction of the plant for stamps cannot be neglected. Considering the short life of most silver mines in this country, this item cannot be taken at a lower rate than 15 per cent. per annum. If we take the running time of a mill at 350 days in the year, and consider that the mill with stamps will cost $10,938 more than one with rolls, the interest and amortization amount to $4.68 per day.

*Summary.*—From the above we find the following daily saving in a mill with two sets of Krom's rolls, as compared with 30 stamps:

| | |
|---|---|
| Wear and tear and repairs | $10 55 |
| Interest and amortization | 4 68 |
| Fuel, 2 cords of wood, at $6 | 12 00 |
| Total | 27 23 |

If no great accuracy can be claimed for this estimate, it is the best which can be given at present, and it is sufficiently correct to prove the economy of rolls beyond any doubt.

Mr. Krom and Mr. Clark claim a much greater saving in favor of rolls than that stated above. The future will demonstrate the correctness or fallacy of this view.

Even if we consider two sets of rolls equal in capacity to only 20 stamps, there still remains a considerable margin in favor of rolls.

4. *The chloridizing roasting of the ore.*—The reverberatory furnace has universally been superseded by mechanical furnaces. Of these three types are in use:

(1.) Revolving cylinder furnaces, which roast a charge.

(2.) Inclined revolving cylinder furnaces, working continuously.

(3.) Shap furnaces, which roast the ore as it falls through a heated chamber.

Mr. William Brueckner is the inventor of the first type. The first experimental Brueckner furnace was erected at San Francisco, Cal., in 1864. In the year 1867 it was introduced in the silver mills of Georgetown, Colo. The construction of this furnace has since then been more or less modified, the most marked change being that carried out by Mr. O. Hofmann, at the Silver King mill, Arizona, by providing the cylinder with a fire-place at each end.

The Stetefeldt furnace, the only successful representative of the third type, was introduced in 1869 at the Auburn mill, near Reno, Nev. It has been much improved in details of construction. Its imitations were in no instance improvements of the original, and had only a short-lived existence. The second type of furnaces, although they originate from the White furnace, an older patent than that of Stetefeldt, did not occupy a prominent place until after the Stetefeldt furnace had been largely introduced, and Mr. Howell had combined the White cylinder with the auxiliary fire place for roasting the dust, one of the principal features of the Stetefeldt furnace. The first Howell furnace was built in 1872 at the Citizens' mill, Austin, Nev. Later on the construction of this type without the auxiliary fire-place found again a few advocates, and new names were invented—for instance, the "Oxland." That such furnaces are decidedly inferior, because they effect a very incomplete chlorination of the dust, is acknowledged by professional metallurgists.

I cannot notice here the great number of inventions which either are recorded only in the Patent Office or had a mere ephemeral existence, or, like the O'Harra furnace, never played an appreciable part in the production of silver bullion. These furnaces perform their operations more or less satisfactorily, much depending upon the skill of their management. All of them effect a great saving in the expense of roasting as compared with the reverberatory furnace. For mills of small capacity the Brueckner furnace is to be recommended. In mills of large capacity the other types work cheaper, especially as far as fuel is concerned. The Stetefeldt furnace excels on account of its durability and large capacity, and in that the power required to run it is merely nominal. It has been adopted in the best constructed and most successful mills of Nevada, Utah, and Montana.

5. *The extraction of the silver from the roasted ore.*—Two processes only are practiced for the extraction of silver from roasted ores, namely, amalgamation, and lixiviation by hyposulphite solutions.

*Amalgamation.*—I have already stated that the use of the pan for amalgamation of roasted ores is characteristic of American silver mills, the barrel process becoming soon obsolete. The long time necessary to complete the amalgamation, and the greater delicacy required in the manipulation of the process, were the principal reasons which drove the barrel out of the field. The foundries, no doubt, had also a large share in the introduction of the pan, which was more profitable to their pockets. Regarding the construction of the pan, it soon became evident that all complicated designs were of no merit, and the so-called "combination pan" was generally adopted. In the settler system comparatively little progress has been made, and it is here where most of the quicksilver is lost. The Boss system of elevating quicksilver, or the bucket elevator, is found in every well-appointed mill. The retorting of the amalgam is still done in the old way, and a new system, introduced at the Lexington mill, Montana, namely, retorting with a current of air and suction, has not given such favorable results as were expected. In conducting the process of amalgamation itself no important change has taken place. The reduction of the silver chloride by granulated zinc, or rather zinc amalgam, although excellent in results, has found its way into a few mills only. For melting retorted bullion into bars, the Lexington mill is the first one which has successfully introduced a reverberatory furnace for that purpose. At the Manhattan mill, Austin, Nev., reverberatory furnace melting had again been abandoned.

*Lixiviation with hyposulphite solutions.*—The lixiviation process with hyposulphite solutions is now entering into serious competition with amalgamation. It was first introduced in the United States in 1874, at Melrose, Cal., by the late Mr. G. Knestel. Subsequently lixiviation works were erected at Galena, Nev., at Monitor, Cal., and at the Martin White mill, Nevada. All these establishments were on a small scale and their existence was of short duration. The first successful introduction, on a large scale, was at the Silver King mill, Arizona, by Mr.

O. Hofmann, in 1880. The next mill with lixiviation plant was the Bertrand, built at Geddes, Nev., in 1882, followed by the Mount Cory mill, Nevada, in 1883. So much interest is manifested in the lixiviation process, and such radical improvements have recently been made in it by Mr. E. H. Russell, that a brief discussion of the subject will not be out of place. Those who wish more detailed information I will have to refer to a paper which is to appear in the Transactions of the American Institute of Mining Engineers.

In the lixiviation of silver ores by means of a hyposulphite solution two difficulties have heretofore been met with, which have rendered the process inapplicable in many cases: (1) The difficulty of producing bullion free from lead; (2) the necessity of a very perfect chloridizing roasting, since the hyposulphite solution acts only imperfectly upon metallic silver and such of its combinations which have not been transformed into the chloride by the roasting process. In the amalgamation of roasted silver ores bullion almost entirely free from lead is produced, if certain precautions are taken, even in case the ore contains a large percentage of lead minerals. If native silver occurs in the ore which is not entirely converted into chloride by roasting, this silver amalgamates readily. Silver compounds, too, which are not converted into chloride, are decomposed, to a certain extent, and the silver is amalgamated, especially if the roasted ore contains soluble copper salts. Hence a larger percentage of silver is in many cases extracted by amalgamation than that shown to be present as chloride, according to the customary chlorination tests. Mr. Russell's improvements in lixiviation consist:

1. *In a practical and cheap method of precipitating the lead by itself from the hyposulphite solution.*

2. *In the application of a solution containing a double salt of sodic and cuprous hyposulphite, which reacts upon and dissolves silver compounds not soluble in sodium or calcium hyposulphite.* He calls this solution the "extra-solution," to distinguish it from the ordinary sodium hyposulphite solution without copper.

*Separation of lead from a hyposulphite solution containing copper and silver.*—Mr. Russell discovered that lead can be completely precipitated from a hyposulphite solution by sodium carbonate as lead carbonate, while silver and copper remain in solution. In working on a large scale the commercial soda-ash is used for this purpose. An extra series of precipitating tanks has to be provided. The lead carbonate settles quickly, and the clear solution is decanted into the silver precipitating tanks, where copper and silver are precipitated by sodium sulphide. The lead carbonate is collected and sold to smelting works.

*The treatment of the ore by the extra solution.*—If to a solution of sodium hyposulphite copper sulphate is added in the proportion of two of the former to one of the latter, the reagents completely decompose each other, a double salt of sodic and cuprous hyposulphite being formed. In case concentrated solutions have been used this double salt is precipitated as a canary-yellow powder. It is not easily soluble in water, but dissolves readily in a sodium hyposulphite solution of 2 per cent. concentration. A solution of this double salt exerts a most energetic decomposing and dissolving action upon metallic silver, silver sulphide, and combinations of silver with antimony and arsenic. If a charge of roasted ore is first treated with an ordinary hyposulphite solution to extract the silver chloride, and subsequently with extra solution, an additional amount of silver is extracted which, by using the old method only, would have been lost in the tailings. Experiments carried out at the Ontario mill, Utah, show, with well chloridized ores, a difference of 4½ per cent. in favor of Russell's process, and from 2 to 3 per cent. more silver extracted than by amalgamation. But with ores of low chlorination the difference may rise above 30 per cent. in favor of the extra solution. In applying the extra solution it is used for several charges in succession before the silver is precipitated from it, together with copper, by sodium sulphide.

*Improved process for treating the sulphides.*—It cannot be denied that the handling of the sulphides is a weak point in the lixiviation process. In roasting such rich products a mechanical loss, and a loss in silver by volatilization, cannot be avoided. The by-product of rich copper matte, obtained in melting the roasted sulphides, is also undesirable. The following process is designed to obviate existing difficulties. The sulphides are dissolved, without previous drying, in sulphuric acid, with addition of niter. After complete decomposition has taken place the silver is precipitated from the solution by metallic copper. From the copper solution copper sulphate is obtained by evaporation and crystallization. A great saving in niter can be effected if the nitric oxide escaping in this process is, according to well-known chemical reactions, reconverted into nitric and nitrous acid, which are absorbed by sulphuric acid. This nitrated acid is then used for oxidizing fresh charges of sulphides.

*Amalgamation and lixiviation by Russell's process compared.*—Without entering into detailed calculations, I will only point out the principal items which are in favor of lixiviation, as compared with amalgamation.

1. In amalgamation the fineness to which ore has to be crushed is determined by the capacity of the settler to work off coarse sands without material loss of quicksilver. It is not practicable to use a coarser screen than No. 30, if the crushing is done by stamps. This is almost equivalent to sifting through a No. 40 revolving screen, if the crushing is done by rolls. In lixiviation pulverizing as coarse as possible is desirable. The limit of coarseness is determined by the roasting process. It depends upon the character of the ore, and principally upon the manner in which the silver-bearing minerals are disseminated in the gangue.
2. The original cost of the lixiviation plant is much lower than that of pans and settlers. A further saving is effected by a reduction in size of the engine and boilers, the power required for pumping solutions, &c., being merely nominal.
3. In amalgamation the pans and settlers consume not less than 1¼ horse-power per 24 hours for each ton of ore.
4. In large mills the quantity of quicksilver in rotation represents a capital of from $30,000 to $40,000, while the stock of chemicals required for lixiviation does not cost more than one-tenth of this amount.
5. With Russell's improvements the percentage of silver extracted is much higher than by amalgamation.
6. Lixiviation by Russell's process requires a less careful chloridizing roasting. That in some cases salt may be entirely dispensed with is indicated by experiments made at the Ontario mill.
7. The value of the lost quicksilver, and cost in wear and tear of the pans and settlers, amounts to more than that of the chemicals consumed in the lixiviation-process.
8. The lixiviation process permits the extraction of copper and lead as valuable by-products.
9. The sulphides from the lixiviation process can be much easier converted into fine bars than the bullion obtained in amalgamation.

10. Amalgamation is invariably injurious to the laborer's health.

In view of these advantages, coupled with a reduction of the cost in crushing by using rolls in place of stamps, we stand before a revolution in the reduction of silver ores, to which this process can be applied, rarely equaled in the history of metallurgy. It is fair to presume that in lixiviation mills of large capacity, with rolls, the cost of producing silver will be lessened nearly one-half, as compared with the present system of stamps and amalgamation, and in some cases the saving will be even greater.

# THE METALLURGY OF ARGENTIFEROUS COPPER COMPOUNDS.

By Henry M. Howe, A. M., M. E.

## INTRODUCTION.

§ 1. In describing in the following article four of the principal wet methods of treating argentiferous copper compounds, and the new Hunt & Douglas process, which is certainly of great promise and interest, the writer has not so much aimed at giving exact details of operations and of apparatus, which necessarily vary indefinitely with the requirements of each case and with the whim of the superintendent, as at elucidating—1st, the chemical principles which underlie each process, a clear understanding of which is indispensable for intelligent work; and, 2d, the economic features of the several methods. These two elements determine the range of applicability of the different processes, a matter which seems to be one of the most important of which metallurgical writers can treat, though one from which they generally shrink, with such specious excuses as that "local conditions must govern the choice of processes," or that "it is impossible to lay down general rules." It is indeed impossible to lay down absolute and rigid rules of universal application, but it is far from impossible to indicate the general classes of ores and the conditions which are favorable and unfavorable to the different processes. This the writer has especially endeavored to do, and to that end has compiled the table in § 2. This table makes no pretensions to completeness, nor can its statements be taken as absolute; they are intended as suggestive, not as dogmatic. In special cases it will be expedient to treat certain classes of substances by other processes than those here recommended for them. But it is hoped that the table may be of service in indicating briefly, and so that those who run may read, the more prominent economic conditions and the classes of argentiferous substances to which some of the most important processes are especially fitted, and some of the salient features of those processes.

At the end of the article will be found a table indicating briefly some of the prominent effects produced by a number of important reagents, both in the wet and dry ways, on silver and several of its compounds. It does not aim to be complete, and is merely for rapid reference.

The writer regrets that, owing to lack of time and to the difficulty of obtaining information, he is unable to give an elaborate description of the electrolytical separation of silver and copper, which promises to be of very great importance in the immediate future.

In receiving the comparisons which are made between the costs of the plants required by the several processes discussed, allowance must, of course, be made for variations in their relative costs, due both to local differences in the relative prices of the various materials which are used in very different proportions in the different plants, and for variations in the composition and quantity of the material to be operated on, which will affect the costs of plants for different processes differently. These variations complicate the matter so much that they greatly lessen the value of the comparisons.

§ 2. TABLE I.—*Indicating the applicability, requirements, &c., of some of the more important silver processes.*

A.—FOR ARGENTIFEROUS ORES NOT CONTAINING MUCH COPPER OR LEAD.

| Name of process. | Applied direct to the ore or after smelting or calcining. | | Description. | Chief applicability and requirements. | Things which should be at least comparatively cheap where process is used. | Remarks. |
|---|---|---|---|---|---|---|
| 1. Tina or Cooper. | Direct to the ore | Amalgamation. | Ore amalgamated in stationery iron-bottomed wooden tubs with revolving iron arms, with Hg only. | Free-milling ores (Chili) | Mercury | |
| 2. Arrastra | | | Ore amalgamated in arrastra with Hg or preferably amalgam of Cu or Ag; amalgam allowed to accumulate during several charges. | Native silver and silver sulphide, free from base sulphides and rebellious combinations, in remote places where machinery is obtained and repaired with difficulty. Especially for auriferous silver ores. | Mercury and power | |
| 3. Cazo | | | Pulverized ore boiled in copper-bottomed stone or wooden cauldrons with salt, and later with Hg, which amalgamates Ag after it is reduced by the Cu. | Rich free-milling ores in remote places. | Mercury | |
| 4. Patio | | | Pulverized ore trodden in 100 ton heaps for fifteen to forty-five days, first with salt, later with $CuSO_4$ and Hg. Au is very imperfectly extracted. | Free-milling ores, and more especially the easily decomposed sulphides, nearly free from other sulphides, arsenides, and antimonides, only in warm climates, and especially in dry, isolated places where fuel, salt, and water are dear. | Horse or mule power and mercury. | |
| 5. Washoe | | | Raw ore ground in steam-heated iron pans, first alone or with salt and $CuSO_4$ then with Hg. Au favorably extracted. | Ores not containing much base metal. Lean ores even when comparatively rebellious, but rich ores only when comparatively free milling. | Power and mercury | |
| 6. Kröhneke | | | Raw or rotated in barrels first with hot brine and Zn amalgam, later with Hg and $Cu_2Cl_2$. | Rebellious ores with sulphur, arsenic, antimony, &c., where fuel is dear. | Mercury and salt | |
| 7. Reese River | | | Chloridizing-roasted ore ground in steam-heated iron pans with Hg. Base chlorides if abundantly present are previously leached out with hot water. | Rebellious ores, and even only moderately rebellious rich ores, especially if auriferous. | Power and mercury | Salt and fuel for calcining. |
| 8. European Barrel | | | Chloridizing-roasted ore rotated in barrels with metallic Fe or Cu to reduce $CuCl_2$ and Ag salts, then with Hg. Au imperfectly extracted. | Rebellious ores, and even only moderately rebellious rich ores, especially if not auriferous. | Mercury | |
| 9. Patera | After calcining with salt. | | Base chlorides leached from chloridizing-roasted ore with water. Ag then leached with sodium hyposulphite and precipitated with sodium sulphide. | At least moderately rich rebellious ores, especially if base, and when fuel and salt are obtainable and power is not cheap. | Sulphate of soda and sulphur. | |

| | | | | | | |
|---|---|---|---|---|---|---|
| 10. Kiss | | Leaching. | Base chlorides leached from chloridizing-roasted ore with water; Ag and Au then leached with calcium hyposulphite and precipitated with calcium sulphide. Remaining Au may be chlorinated with Cl gas, leached with water and precipitated with $FeSO_4$. | At least moderately rich rebellious ores, especially if auriferous or base, and when fuel and salt are obtainable and power is not cheap. | Lime and sulphur | |
| 11. Lead Smelting | | Smelting. | Ore smelted with Pb-yielding substances; resulting Pb refined and desilverized. | Readily fluxed and at least moderately rich ores, where Pb-yielding substances are obtainable. | Fuel | |
| 12. Pyritic Smelting. | | | Ore smelted with matte-yielding substances; resulting matte concentrated if necessary, desilverized by Pb, or calcined and leached or amalgamated. | Readily fluxed and at least moderately rich ores, where matte or speisse-yielding substances are obtainable. | | |
| 13. Direct cupellation, refining or crucible melting. | | | | Very rich ores and argentiferous substances. | | |

### B.—ARGENTIFEROUS ORES CONTAINING MUCH LEAD, WITH OR WITHOUT MUCH COPPER.

| | | | | | |
|---|---|---|---|---|---|
| 14. Lead Smelting | | Ore smelted, resulting Pb refined and desilverized by Parke's or Pattinson's process; Cu obtained in a matte or speisse, treated as in C. | Where freight on resulting lead is not excessive, fuel obtainable and ores readily fluxed. | Fuel | |
| 15. Patera or Kiss. | After calcining | Base chlorides leached from chloridizing-roasted ore with water; $CuCl_2$ precipitated on Fe; Ag then leached with hyposulphite of Na or Ca and precipitated with sulphide of Na or Ca. | Where freight on argentiferous lead from smelting would be excessive, ores difficult to flux and smelting fuel dear. | Sulphate of soda or lime, and salt and sulphur. | |

### C.—ARGENTIFEROUS ORES CONTAINING MUCH COPPER BUT NOT MUCH LEAD.

| | | | | | |
|---|---|---|---|---|---|
| 16. Ziervogel | After smelting. | Matte oxidizingly roasted, forming CuO and $Ag_2SO_4$ which is leached with water and ppted. on Cu. The CuO is recovered from the residues by smelting. | Pure matte, where very great skill is obtainable and salt, iron, power, and sulphuric acid are dear; also to less pure mattes if residues are treated by Augustin process. | Fuel and refractory materials | Arsenic and antimony cause loss of silver and contaminate the resulting copper. |
| 17. Augustin | | AgCl leached from the oxidizingly and then chloridizingly roasted matte with brine. CuO recovered from the residues by smelting. | Comparatively pure mattes, not rich in zinc, where iron, power, and sulphuric acid are dear; also to residues of Ziervogel process and occasionally to black copper. | do | |

§ 2. TABLE I.—*Indicating the applicability, requirements, &c., of the more important silver processes*—Continued.

C.—ARGENTIFEROUS ORES CONTAINING MUCH COPPER BUT NOT MUCH LEAD—Continued.

| Name of process. | Applied direct to the ore or after smelting or calcining. | Description. | Chief applicability and requirements. | Things which should be at least comparatively cheap where process is used. | Remarks. |
|---|---|---|---|---|---|
| 18. Longmaid or Henderson. | After calcining... | From the chloridizingly roasted ore the Cu and Ag are leached with water and weak HCl; the Ag recovered by one of the next four methods (19–22): the Cu ppted. on scrap iron. | Ores very rich in iron, with but little copper and silver, little or no lime, magnesia, &c.; where smelting fuel is dear and the iron oxide residue and $H_2SO_4$ are in demand. | Salt and iron ................ | Arsenic and antimony cause loss of silver and contaminate the resulting copper. |
| 19. Claudet........ | .................... | Ag ppted. as Ag I from solution of chlorides of Cu and Ag, with $ZnI_2$ regenerated in the process. | Skill and care to prevent formation of cuprous chloride.<br>Solutions of mixed chlorides of copper and silver. | | |
| 20. Gibb........... | .................... | Ag and a little Cu fractionally ppted. from solution of chlorides of Cu and Ag, with $H_2S$. | .......................... | | |
| 21. Snelus......... | .................... | Ag and a little Cu fractionally ppted. from solution of chlorides of Cu and Ag with pulverized Fe. | .......................... | | |
| 22. Jardine and Chadwick. | .................... | Ag ppted. from solution of chloride of Cu and Ag by diluting and adding acetate of Pb. | .......................... | | |
| 23. Phillips........ | .................... | From the cement Cu and Ag, precipitated together on Fe, the Ag is leached with brine after calcining with salt and soda. | .......................... | | |
| 24. Monnier....... | After calcining... | Cu and Ag sulphatized by calcining with $Na_2SO_4$; leached with water, Ag ppted. on Cu and Cu on Fe. | Ores rich in iron and free from lime, magnesia, &c. | Iron and either sulphuric acid and salt or $Na_2SO_4$. | Arsenic and antimony contaminate the resulting copper. |
| 25. Liquation...... | After smelting. | Ag and Pb sweated or liquated from argentiferous black copper by prolonged heating below the melting point of Cu. Heavy loss of Ag. | Obsolete or obsolescent; probably nowhere advantageous now. | Fuel for the production of black copper or matte. | |
| 26. Abdarr........ | | By repeatedly smelting argentiferous copper matte with alloys of Pb and Cu, the Ag is concentrated into Pb-bearing black copper, which is liquated; the Cu is simultaneously concentrated into a desilverized matte. | | | |
| 27. Kupferauflösung. | | By smelting matte of Cu and Ag with Pb or PbO and a little black copper, the Ag is concentrated in the lead; the Cu is concentrated in the desilverized matte. | | | |

| | | | | | |
|---|---|---|---|---|---|
| 28. Amalgamation. | After calcining... | Matte or black copper, dead roasted with salt and $FeSO_4$; amalgamated in barrels. | Pure matte and black copper where sulphuric acid and power are dear. | Mercury.. | Arsenic and antimony do not contaminate the resulting copper. |
| 29. Vitriolization or Sulphuric Acid. | | Cu dissolved from granulated black copper or dead roasted matte with dilute $H_2SO_4$. $CuSO_4$ crystalized, and Ag extracted from the residues. | Impure or pure matte or black copper where power is dear, sulphuric acid cheap, and sulphate of copper in demand. | Sulphuric acid. | |
| 30. Electrolysis.... | | Cu dissolved from slabs of black copper suspended as anodes in bath of $CuSO_4$ and deposited on pure Cu slabs as cathodes. | Impure or pure black copper where power is cheap and sulphuric acid is dear, especially if sulphate of copper is not in demand. | Power..... | |
| 31. Hunt and Douglas new Process. | | From oxidizingly roasted ore CuO is dissolved by $H_2SO_4$; from this solution, after adding a soluble chloride, Cu is precipitated as $Cu_2Cl_2$ by $SO_2$, generating $H_2SO_4$ for dissolving more CuO. $Cu_2Cl_2$ converted into Cu or $Cu_2O$ by Fe or milk of lime. Ag extracted from residues. | CaO or MgO-bearing or difficultly fluxed ores, especially if impure or lean, where iron, salt, fuel, power, and sulphuric acid are dear and brimstone, pyrites, or other $SO_2$-yielding substance is cheap. | Sulphur or sulphur-bearing substances. | |
| 32. Deby.......... | Direct to the raw ore. | Cu dissolved from raw pyritous ores with $H_2SO_4$ and $Fe_2(SO_4)^3$, and ppted. on Fe. Resulting $FeSO_4$ solution is passed through a tower with $SO_2$ and excess of air, regenerating $H_2SO_4$ and $Fe_2(SO_4)^3$. Ag extracted from residues (?). | Ores free from lime and magnesia, lean in copper and difficult to flux, where fuel and salt are dear and iron and some $SO_2$-yielding substance is cheap. | Iron and sulphur or sulphur-bearing substances. | |
| 33, Dœtsch........ | | Cu (and Ag?) dissolved from raw pyritous ore with $Fe_2Cl_6$; Ag (?) separated as in Longmaid process; Cu pptd. on Fe. The resulting $FeCl_2$ passed through tower with Cl gas, regenerating $Fe_2Cl_6$. | Ores free from lime and magnesia, lean in copper and hard to flux, where fuel is dear and either (1) salt and sulphuric acid, copperas, or niter; or (2) hydrochloric acid and binoxide of manganese are cheap. | Iron, and substances yielding chlorine. | |
| 34. Patera or Kiss. | After calcining... | $CuCl_2$ leached with water from chloridizingly roasted ore and ppted. on Fe. Ag and Au leached from residue with hyposulphite of Na or Ca. and ppted. with sulphide of Na or Ca. | Ores rich in silver and difficultly fluxed, where smelting fuel is dear. | Salt, iron, sulphur, and either lime or sulphate of soda. | |

D.—BULLION.

| | | | | | |
|---|---|---|---|---|---|
| No. 13, 16, 17, 25, 26, 27, 28, 29, 30, above. | ...................... | See description above. | | | |
| 35. Miller.......... | ...................... | Cl passed through molten alloy chloridizes Ag completely, but is inert on Au. The fusible AgCl poured off from the solidified Au and reduced by Fe, Zn, or electrolytically. | Argentiferous gold, especially where sulphuric acid is dear. | Substances yielding chlorine.. | |

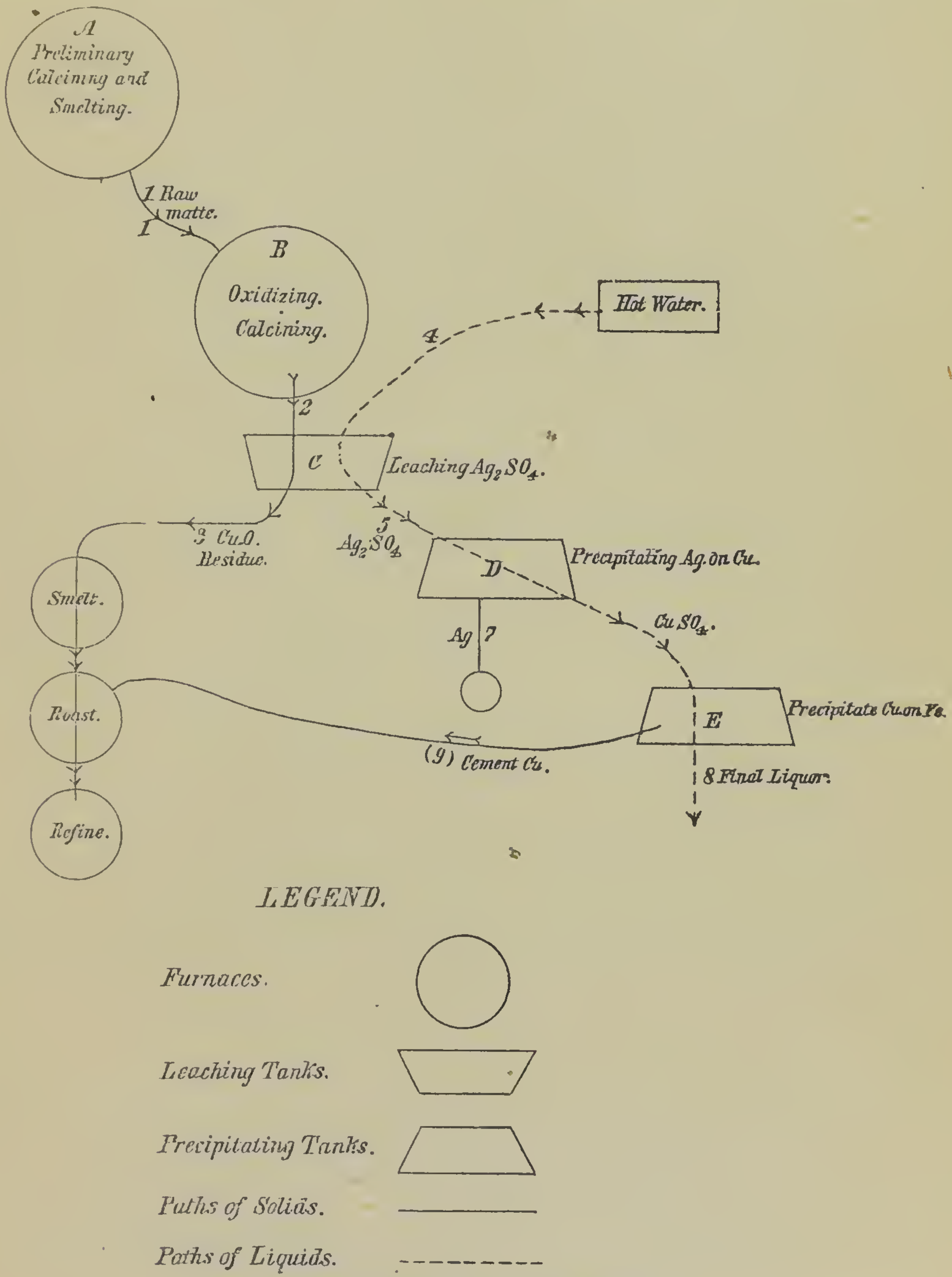
§ 2. TABLE I.—*Indicating the applicability, requirements, &c., of the more important silver processes*—Continued.

D.—BULLION—Continued.

| Name of process. | Applied direct to the ore or after smelting or calcining. | Description. | Chief applicability and requirements. | Things which should be at least comparatively cheap where process is used. | Remarks. |
|---|---|---|---|---|---|
| 36. Sulphuric Acid Parting. | .................... | Boiling strong $H_2SO_4$ dissolves Ag and Cu, but not Au; Ag reduced by Cu from original solution diluted; or $Ag_2SO_4$ crystalized and reduced by Fe or $FeSO_4$. Au, if necessary, heated in fused bisulphate of soda to remove remaining Ag. | Both to argentiferous gold and auriferous silver. | Sulphuric acid ................ | |
| 37. Nitric Acid Parting. | .................... | From the granulated alloy hot $HNO_3$ dissolves Ag and Cu, but not Au. Ag is ppted. as AgCl and reduced by Zn. | Auriferous silver ........................ | Nitric acid .................. | |
| 38. Electrolysis .... | .................... | Ag but not Au dissolved from crude Ag slabs suspended as anodes in solution of $Ag_2SO_4$, and is deposited on pure Ag plates as cathodes. | Auriferous silver, where acids are dear and power cheap. | Power ......................... | |
| 39. Sulphur ........ | .................... | Ag and Cu (but not Au) are sulphidized by melting granulated alloy with S, the Au collected with metallic Ag or Fe, the $Ag_2S$ reduced by Fe. | ................ Obsolete. Possibly applicable in remote places where acids and power are dear. | | |
| 40. Sulphide of antimony. | .................... | Alloy repeatedly melted with sulphide of Sb; Au alloys with Sb, and is refined by blast of air. Ag is matted. | ................ | | |
| 41. Poussee ........ | .................... | Alloy repeatedly melted with niter to slag the Cu. An alloy of Ag and Au remains, to be otherwise parted. | Highly cupriferous bullion. | | |
| 42. Salt cementation. | .................... | Ag (but not Au) is chloridized by cementing granulated alloy in porous earthenware with salt. AgCl separated from Au by washing, and reduced by Fe, Zn, or electrolytically. | ................ | | |

## THE ZIERVOGEL PROCESS FOR COPPER MATTES.* BASIS OF THE PROCESS.

§ 3. This very simple though delicate process is based on the fact that when the $Ag_2S$ in copper mattes is heated with an excess of air at the temperature at which the $CuSO_4$ formed earlier in the operation is decomposed, the $H_2SO_4$ and $SO_3$ generated by that decomposition attack the Ag, forming $Ag_2SO_4$, soluble in water, the Cu and Fe being mainly converted into insoluble oxides.



Tree illustrating the Ziervogel process.

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* Kerl, Grundriss der Metallhuttenkunde, 1881 p. 352. Rivot, Principes Généraux du Traitement des Minérais Métalliques, 1871, I, p. 370–425. Mineral Resources West of the Rocky Mountains, 1876, p. 379–386. Trans. Am. Inst. Mining Engineers, IV, 285.

### BRIEF OUTLINE.

The operations may be conveniently divided into the following heads :

[A]* Generally repeated calcinings and smelting for rich matte.

[B] An oxidizing calcining of the matte to sulphatize the Ag.

[C] Leaching the $Ag_2SO_4$ from the matte with water, yielding residues [3] and an argentiferous solution [5].

[D] Precipitating the Ag on Cu, washing and melting it.

[E] Precipitating the Cu dissolved in [D] on scrap iron.

[F] Treatment of the residues [C] for Cu (and Au if present).

Of these operations those under [B], [C], [D], and [E] alone belong to the Ziervogel process proper.

The argentiferous copper ore is calcined and smelted, repeatedly if necessary, yielding a comparatively rich matte, [1]. This is subjected to a very long and careful oxidizing calcination [B], (the latter part of the operation being preferably performed in a special furnace after regrinding), by which the Ag is converted into soluble sulphate, most of the Cu and nearly all the Fe being converted into insoluble oxides. The calcined matte [2] is leached with slightly acidulated hot water [4] which dissolves nearly all the Ag but almost no Cu or Fe, the solution thus obtained [5] being deprived of its Ag by precipitation on scrap Cu in [D]. The Cu thus dissolved is in turn precipitated on scrap Fe, the coarser portion of the Cu thus precipitated being used for the precipitation of Ag, the finer portions [9] being at once refined. The liquor [8] robbed of its Cu is run to waste. The precipitated Ag [7] is washed with dilute $H_2SO_4$, dried and melted yielding fine bars. The residues [3] from [C] are smelted, roasted,† with separation of Au in bottoms, and refined. Special local conditions may of course modify this procedure.

*Treatment of black copper.*—Argentiferous black copper may be treated by this process by granulating it, calcining it, grinding it very fine, and then calcining it with a little pyrites or ferrous sulphate so as to obtain synthetically a mixture of the composition of partly calcined copper matte.

As a study of the preliminary calcinings and smelting would carry us beyond the limits of this paper, let us pass at once to the oxidizing calcination of the argentiferous copper matte.

### [B] CALCINATION OF THE MATTE.

§ 4. The operation is performed in Germany in reverberatories with two and sometimes even three or four hearths directly above one another. Through holes in each of the upper hearths the matte is successively transferred from hearth to hearth.

After being pulverized so as to pass through a screen having about 37 meshes to the linear inch, the matte is charged in lots of 5 to 6 cwts. on the upper hearth. After some 30 minutes 5 pounds of coal-dust are stirred into it and the whole is stirred for about 4½ hours. Then 25 pounds more of coal-dust are stirred into it, when, the calcination of

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[*] The letters and figures in brackets refer to the accompanying tree.

[†] In this paper the word "roasting," for the sake of uniformity, is used exclusively to designate the prolonged oxidizing fusion for metallic copper (blister) in the Welsh reverberatory process, the words "calcining" and "burning" refering to oxidizing, chloridizing, or desulphurizing operations carried on in the dry way with the aid of heat but without fusion, be it in furnaces, heaps, or kilns.

the previous charge on the lower hearth having meanwhile been completed, the charge is transferred from the upper to the lower hearth, a fresh charge being immediately placed on the upper hearth. Now commences the *second period* of the calcination, which lasts about 2¼ hours, and during which no fuel is charged on the grate, the temperature gradually falling from 500° or 550°C. to 300° or 400°C. During the first hour of this period the damper is closed; it then remains open until the end of the second period.

During the third and last period the fire-place is fed with short-flamed wood or coal to avoid a smoky reducing flame, the temperature gradually rising, till, at the end of the period, which generally lasts about 5½ hours, it has reached 750° or 770° C., which may be roughly described as a full red heat.

The total length of the operation is thus about 13¼ hours. During most of this time the matte has been diligently stirred, and, in order to have the calcination progress as uniformly as possible throughout the different portions of the mass, the hotter portions nearest the fire-bridge have been frequently made to change places with the cooler portions which lie at the farther and cooler end of the hearth, and similarly the parts exposed to the more strongly oxidizing atmosphere near the doors and those remote from the doors are transposed.

If the residues after leaching contain over 0.03 per cent. Ag, they are recalcined.

*Description of the process as carried on in Colorado.**—The matte, containing about 35 per cent. of copper, is first crushed so as to pass through a screen of eight meshes to the linear inch, and calcined in an open reverberatory calcining furnace for 24 hours (the temperature gradually rising from below visible redness to a bright cherry red), after which it contains about 6 per cent of sulphur. It is now crushed so as to pass through a screen with sixty meshes to the linear inch, and is calcined in charges of 1 ton each for from four to five hours in an open reverberatory calcining furnace, with a hearth about 10 feet 6 inches by 11 feet 6 inches, and with a very high roof, which is about 28 inches above the hearth in the neighborhood of the fire-bridge. The temperature is carefully regulated, rising gradually from a dead black till it reaches a dull red at the end of two hours, and after that rising very slightly. The atmosphere is kept as oxidizing as possible, the portions of matte in the hotter parts of the hearth being shifted to the cooler portions, and *vice versa*, often enough to insure that the chemical reactions shall progress substantially uniformly throughout the mass. It is for the same end that the matte is reground after the preliminary calcination. Very fine grinding is unnecessary for that operation since the first part of the oxidation progresses readily even in comparatively coarse material. Moreover, even if it were ground very fine before the preliminary calcination, it would still be desirable to regrind it afterwards, since during the early part of the operation the matte is so fusible, from the presence of basic ferric sulphates, that it is liable to frit into pellets so large that the delicate chemical reactions of the final calcination would progress more rapidly on their surfaces than in their interiors. This regrinding is probably more necessary in the case of mattes comparatively lean in Cu and rich in Fe than in the rich Cu mattes treated in Germany, owing to the larger proportion of the fusible basic ferric sulphates developed in the former.

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* Mineral resources west of the Rocky Mountains 1876, p. 379.

*Tests.*—The operation is controlled by carefully observing the solution obtained by leaching samples, taken from the different portions of the charge from time to time, with water. The solution obtained from the early samples will be strongly green, indicating that a great deal of $Fe\,SO_4$ is present, yielding *green* vitriol; with the progress of the calcination we get a blue-colored aqueous solution with less and less green, showing that the $FeSO_4$ is disappearing and $CuSO_4$ is being formed in its place. yielding *blue* vitriol. In the aqueous solutions now obtained we get but a slight precipitate with salt, indicating that but little Ag is being dissolved. The appearance of bright spangles indicate that some $Ag_2SO_4$ exists, and that as it dissolves its Ag is precipitated in the metallic state by the $Cu_2O$ or FeO present. The calcination must be prolonged till the blue color nearly disappears, indicating that almost all the $CuSO_4$ has been decomposed, and till the spangle reaction no longer takes place, whose absence indicates that the Fe and Cu have been thoroughly oxidized. As these metals are no longer in a condition to precipitate the Ag from its solution obtained in the subsequent operation, and as an addition of salt to the test aqueous solution now produces a copious curdy precipitate of AgCl, indicating that much Ag is soluble as $Ag_2SO_4$, the charge is immediately drawn from the furnace.

*Estimated cost of calcining in Colorado, per ton of matte.*

| Items. | Preliminary calcination. | Final calcination. | Total. |
|---|---|---|---|
| Cords of wood | 0. 5 | 0. 4 | 0. 9 |
| Days labor | 0. 62 | 0. 66 | 1. 22 |
| Square feet hearth<br>Surface per ton<br>Matte per 24 hours | 102. | 31. | 133. |
| Length of operaation ........hours | 24. | 5. | 29 |
| Meshes per linear inch of screen through which matte is passed | 8. | 60. | ........... |

## CHEMISTRY OF THE CALCINATION.

§ 5. When the matte, which consists essentially of sulphides of Fe, Cu, and Ag, is calcined, the Fe and Cu become converted first into sulphates and oxides, and finally completely into oxides, the Ag first passing into the condition of sulphate and then to the metallic state. The Fe, however, passes through its cycle of changes more rapidly and at a lower temperature than the Cu does, and the Cu in turn at a lower temperature than the Ag. Hence the reactions take place in the following order: First the Fe is changed into oxide and sulphate; next, while it is passing from this state into that of oxide alone the Cu is becoming converted into oxide and sulphate partly by direct absorption of O from the air, but probably also in large part by the action of the $SO_3$, set free by the decomposition of the iron sulphates. As the temperature rises still higher, the Fe now having in great measure given up its $SO_3$ and our $CuSO_4$, into which nearly all the Cu has now passed, already beginning to yield up its $SO_3$, under the influence of the prolonged high temperature, our $Ag_2S$ at last breaks up.

Percy has shown* that when $Ag_2S$ is calcined alone the Ag passes wholly and directly into the metallic state, no $Ag_2SO_4$ being formed. In calcining argentiferous copper matte, however, $Cu\ SO_4$, and $Ag_2S$, break up at about the same temperature, so that we may suppose that we have metallic Ag and $SO_3$ simultaneously nascent and in intimate contact. Under these conditions the Ag may easily absorb O from the air, and the two nascent compounds unite forming $Ag_2SO_4$.* If we now raise the temperature a little higher, we in turn decompose our $Ag_2SO_4$ obtaining merely metallic Ag, wholly insoluble in water. Indeed, this may apparently occur if we merely expose our $Ag_2SO_4$ longer than is necessary to the temperature at which it forms, and, according to Rivot, we may thus greatly diminish its solubility without even decomposing it.

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* Although Rose (Watt's Dictionary of Chemistry, V, p. 305) and Berthier (Tr. des Essais, 2, p. 781) both state that $Ag_2\,SO_4$ is formed when $Ag_2S$ is calcined at a low heat, Percy's experiments (Percy's Metallurgy, Silver and Gold, I, p. 27) indicate strongly that these writers are in error, and that $Ag_2S$, on being calcined, passes directly to the metallic state, without the formation of $Ag_2SO_4$, at least under all ordinary conditions.

Here we see that it is imperative that the chemical reactions should progress uniformly throughout the whole mass which is under treatment. If one part is heated more strongly than another, or exposed to more strongly oxidizing conditions, its Ag will pass sooner into the condition of $Ag_2SO_4$, which may in turn be decomposed, or at least have its solubility seriously diminished while the Ag in the remainder of the mass is becoming sulphatized. Very fine grinding is needed for the same reason; the individual grains of matte must be so fine that there shall be no considerable difference between the chemical conditions of their surfaces and of their interiors.

As the calcining progresses the Ag passes from the insoluble state of sulphide through the soluble sulphate condition (which is hardly more than a passing phase) to the insoluble metallic state, and our calcination must progress so uniformly that the whole of the Ag shall have left the state of sulphide before any of it has reached the metallic state; and we must catch it just while all the Ag is in this intermediate and quite unstable state of sulphate, in order to dissolve it out with the very mild solvent which the process allows, hot water. And while we dexterously catch it in this transition state, we must make sure that we have broken up nearly all the $CuSO_4$ (whose decomposition requires a temperature approaching that at which $Ag_2SO_4$ decomposes), and that we have thoroughly oxidized all the $Cu_2O$ and FeO. It is very important to have a strongly oxidizing atmosphere, especially during the latter part of the calcination, and for two principal reasons: First, since the Ag is mainly or wholly sulphatized by the evolution of $SO_3$ from the decomposing sulphates of copper (and iron?) it is necessary that the evolution of that $SO_3$ should be copious, and, therefore, that the copper should exist in large quantity as sulphate. But, if we do not have a copious supply of oxygen in the air in our furnace, there will be a tendency to form not $CuSO_4$, but CuO (and even $Cu_2O$) and $SO_2$, the latter reaction requiring only $2\frac{1}{2}$ atoms of O per atom of Cu, while 4 atoms of O per atom of Cu are required to convert the Cu into sulphate, as may be shown by the following equations:

While $2\ Cu\ S + O^5 = Cu_2O + 2\ SO_2$,
$Cu\ S + O^4 = Cu\ SO_4$.

Second, in the early part of the calcination the action of the air, and of the $SO_3$ given off by the decomposing iron sulphates, on the still considerable quantity of undecomposed copper sulphide, yields a great deal of $Cu_2O$; and, indeed, the reducing action of the undecomposed sulphides and of the $SO_2$ evolved may reduce to $Cu_2O$ and FeO or $Fe_3O_4$ some portions of CuO and $Fe_2O_3$ already formed. In the subsequent leaching operation $Cu_2O$ and FeO would precipitate Ag in the metallic state from the $Ag_2SO_4$ dissolved, the precipitated Ag being of course lost in the residues. Hence it is imperative that all the Fe and Cu should be thoroughly oxidized, and during the last part of the calcining the principal aim is their complete oxidation. Gas furnaces, especially regenerative ones, should be particularly adapted to this process, on account of the more strongly oxidizing atmosphere attainable in them.

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* Probably the $SO_3$ also hastens the decomposition of the $Ag_2S$, and also directly attacks Ag, which may have already passed into the metallic state.

The reaction by which $Cu_2O$ and FeO precipitate Ag is as follows:

$$Cu_2O + Ag_2SO_4 = CuSO_4 + CuO + 2Ag.$$

From what has been said, it can easily be seen that the proportion between the Ag, Cu, Fe, and S in the matte is a matter of great moment. First, we must have enough S to yield a copious quantity of $SO_3$ at the moment when our silver sulphide splits up. Next, if we have but little Cu and much Fe the greater portion of the S present will be driven off as $SO_3$ at the low temperature at which iron sulphates are decomposed, and at which $Ag_2S$ is comparatively staple. There being little Cu present, but little S can be held by it to be liberated at the high temperature at which alone it can combine with Ag. The presence of a certain amount of Fe probably favors the sufficient sulphatization of Cu (see MacFarlane's experiments, § 21). An excess of Fe increases the tendency to cake, on account of the fusibility of the basic ferric sulphates.

It is said that the proportion between the Fe, Cu, and S should be such that the matte, before calcining, should be wholly free from moss copper, since the Ag contained in this would not be sulphatized. This is surprising, since the moss copper, which all passes through a 60-mesh screen, is so very finely divided that we should expect it to become quickly oxidized, and that its Ag would be attacked by the $SO_3$ set free by the immediately adjoining portions of matte. The most favorable relation between these three substances seems to be met by having a large amount of Cu, a moderate amount of S, and a small but not too small amount of Fe.

*As and Sb.*—The presence of these elements causes great loss of silver, since they can only be expelled during the calcination to a trifling extent, and since they form arseniates and antimoniates of Ag, on which even the nascent $SO_3$ has hardly any action, and which are entirely insoluble in water, so that the silver they contain remains in the residues after leaching and is lost; they also increase the loss of Ag by volatilizing. Mixing coal with the matte while calcining it, as is (or was formerly) done in Germany, probably expels a considerable proportion of these noxious elements, reducing the non-volatile $As_2O_5$ and $Sb_2O_5$ to the volatile conditions of $As_2O_3$, $Sb_2O_3$, and As. By limiting the amount of free air admitted into the calcining furnace, during the first part of the operation, or by admitting steam with the air to weaken its oxidizing action, so that the As and Sb may become oxidized slowly and thus remain a longer time in their intermediate volatile state of sesquioxide, and by having a large amount of S in the matte so as to drag off the As and Sb as volatile sulphides, we may still further favor their expulsion. The former course if carried far has the disadvantage of tending to expel too much of the S as $SO_2$, while we have already seen that the thorough sulphatizing of our silver requires that much of the S should be retained as sulphate. As and Sb not expelled during the calcining contaminate the Cu recovered from the residues, unfitting it for many purposes, and lowering its selling price.

*Zn and Pb.*—The former volatilizes to a certain extent, dragging off Ag with it.* PbS, by its fusibility, makes the matte cake together. Even if these cakes be broken up so as to expose their interior to the air, still pellets too small to be broken in the furnace will form, enameled on the outside by the fusibility of the PbS, and so protected from the proper action of the air.*

### [C] LEACHING.

§ 6. The calcined matte is leached in wooden tanks with hot water, which is sometimes acidulated with $H_2SO_4$ (to facilitate the solution of the Ag and to prevent the precipitation of basic salts of Fe in the subsequent precipitation of the Ag), until a bright copper plate is not coated by the escaping liquor, in which salt must precipitate no important quantity of AgCl. At the Boston and Colorado smelting works, according to Egleston, 8 to 9 hours are required for this. The extraction of the Ag appears to be delicate, tedious, and unless the calcining has been carried out with the utmost skill and precision, not always complete. The matte is cooled before leaching, since it would cake if wet while still very hot.†

### [D] PRECIPITATING, WASHING, AND MELTING THE Ag.

The solution, which contains nearly all the silver and a small portion of the copper (nearly the whole of the Fe and of the Cu remaining in the residue), is filtered slowly through a mass of plates of metallic Cu, which precipitates the Ag, an equivalent of Cu being dissolved as $CuSO_4$, thus:

$$Ag_2SO_4 + Cu = CuSO_4 + 2Ag.$$

The Ag thus precipitated adheres only slightly to the Cu plates, from which it is readily detached. The precipitating tubs are closed tightly to exclude the air, which, by oxidizing the $FeSO_4$ in the solution, might cause the precipitation of basic ferric sulphate, which would contaminate the Ag, the action being like that shown in the second equation in the next section.

The precipitated Ag is removed from the Cu plates and washed with very dilute $H_2SO_4$ in a tub with a perforated false bottom, beneath which a stream of mixed air and steam is introduced by a steam-jet injector. The hot air bubbling up through the Ag constantly exposes fresh surfaces to the liquor, and at the same time oxidizes any metallic Cu contained in the Ag, and thus enables it to dissolve as $CuSO_4$. After drying, the washed Ag is melted in plumbago crucibles, yielding bars which, at the Boston and Colorado smelting works, are 999 to 999.5 fine, according to Egleston.‡

### [E] PRECIPITATING THE Cu.

§ 7. The Cu dissolved by the precipitation of the Ag, as well as any small portion dissolved direct from the matte by the hot water used to dissolve the $Ag_2SO_4$, is precipitated on scrap iron, the reaction being as follows:

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*The statements on which these remarks about the chemistry of this interesting calcination are based, though the most trustworthy which I have been able to find, seem to me to require further experimental verification before they can be accepted as absolutely true. Nevertheless, they are probably near enough to the truth to afford the metallurgist a good working theory.

† Kerl, Grundriss der Metallhüttenkunde, 1881, p. 356.

‡ Trans. Am. Inst. Eng., IV, p. 276

$$CuSO_4+Fe=FeSO_4+Cu.$$

The tanks should be kept tightly closed during this precipitation to prevent the formation and precipitation of basic ferric sulphates, which would not only consume Fe to no purpose, but also contaminate the precipitated Cu, to be subsequently removed at great expense.

$$30FeSO_4+15O=Fe_2(SO_4)^3\,5Fe_2O_3+9\,Fe_2(SO_4)^3$$

and $$6FeSO_4+3O=2Fe_2(SO_4)^3+Fe_2O_3$$

Of the compounds thus formed, whose composition varies with the strength of the solution and with other conditions, the basic ferric sulphate (e. g., the $Fe_2(SO_4)^3\,5Fe_2O_3$) precipitate and contaminate the simultaneously precipitated Cu, while both the basic sulphate and the normal ferric sulphate $Fe_2(SO_4)^3$ attack and dissolve the iron thus:

$$6Fe_2(SO_4)^3+15Fe+15H_2O=15FeSO_4+30H+Fe_2(SO_4)^3\,5Fe_2O_3.$$

Our $FeSO_4$ now regenerated takes up a fresh quota of O from the air, forming ferric sulphates anew, which in turn dissolve more iron, and so on in a vicious circle, the $FeSO_4$ carrying O from the air to the scrap iron.

It is astonishing that in so many otherwise well-conducted works the consumption of Fe in precipitating Cu is so much increased and the cement Cu so much debased by neglecting the simple, easy, and inexpensive precaution of closing the tanks.

If salt or HCl were cheap and $SO_2$ gas were available, the consumption of Fe for precipitating might be reduced by adding enough salt or HCl to unite with the Cu present to form $Cu_2Cl_2$, and then blowing $SO_2$ through the solution. This would precipitate the Cu as $Cu_2Cl_2$, which (after removing the acid solution) could be then reduced to the metallic state with only half the amount of Fe required to precipitate it from $CuSO_4$; or, still better, by adding milk of lime it could be converted into $Cu_2O$, which is easily and cheaply refined according to Hunt (see §§ 42, 43, and 44).

Where scrap iron for precipitating the Cu is expensive, the precipitation might perhaps in some cases be advantageously effected with milk of lime (without employing NaCl, HCl, or $SO_3$), the objection which usually prevents the use of this precipitant (that it simultaneously precipitates the Fe present, from which the Cu can only be separated with difficulty) having little weight in the Ziervogel process, where the proportion of Fe to Cu in the solution should be very small. $CaSO_4$ would of course precipitate with the Cu. Where water-power is available, the Cu may be precipitated by electrolysis. The amount of copper to be precipitated in the Ziervogel process is in general so small that in the great majority of cases precipitation with iron is preferable on account of its simplicity. The coarser portions of the cement copper may be used for precipitating fresh portions of Ag; the finer are smelted in reverberatory furnaces for blister copper.

### [F] TREATMENT OF THE RESIDUES FOR COPPER (AND GOLD IF PRESENT).

§ 8. The treatment of the residues, from which the Ag has been leached with hot water, varies according to the economical conditions of the different establishments. They should be smelted for matte in reverberatories or shaft furnaces, according to whether (*a*) bituminous coal or wood or (*b*) anthracite, coke or charcoal is cheapest per unit of smelting capacity. If the residues are not sufficiently desilverized, it may indeed be desirable to treat them again by the Ziervogel or Augustin process without smelting them. This will depend to a considerable extent on the amount of iron contained in the matte. If there is much iron, it is desirable to get rid of it by smelting, in which operation, having been thoroughly oxidized in the original Ziervogel calcination, it will pass into the slag, leaving a much reduced weight of matte to operate on. The treatment of the resulting matte will vary according to whether (1) it is free from Ag but contains either Au, As, or Sb; (2) contains Ag but has neither Au, As, nor Sb in important quantity; (3) contains Ag, and either As, Sb, or Au; or (4) contains neither Ag, Au, As, nor Sb.

I will first describe the treatment generally desirable in the first class of conditions, after which it will be easier to comprehend the modifications required by the other classes.

1. *Matte containing either Au, As, or Sb, but free from Ag.*—The matte is first "roasted," *i. e.*, it is slowly melted down in a reverberatory furnace, and there exposed to a current of air as it lies melted. The S becomes oxidized, escaping as $SO_2$ and $SO_3$, in fine bubbles with a peculiar hissing noise. As it escapes Cu begins to separate in the metallic state, and may be detected by its peculiar green and brilliant appearance on suddenly exposing the bottom of the furnace by rapidly and dexterously pushing aside the superincumbent liquid matte with a rabble. Nearly all the Au, As, and Sb contained in the charge will be concentrated in the first portions of metallic Cu which separate in this roasting process. Hence, if the matte contains any important quantity of these elements, the roasting is stopped and the charge tapped out of the furnace as soon as metallic copper or "blister" makes its appearance. We now get two products, the "pimple metal" or "regule" (a very rich matte), and some small lumps of impure metallic blister copper, which are caught in the bottoms of the molds nearest the furnace, through which the whole charge has to flow to reach the molds farther away. These lumps are hence called "bottoms," and the object of separating them is of course (1) to recover the Au, and (2) to eliminate the As and Sb from the bulk of the Cu, and thus to obtain most of this metal free from these highly detrimental elements.

In case the Au, As, or Sb is not sufficiently removed from the matte by the first set of bottoms made, the resulting rich matte may be again melted down, yielding a second set of bottoms, in which a further portion of these elements will now be concentrated. The bottoms are set aside for special treatment, and the matte (pimple metal or regule) is further subjected to the "roasting" process till the S is so far removed that all the matte has passed into the condition of blister copper, which is distinctly metallic, tough, malleable, and copper colored, while the pimple metal is brittle, grayish, and distinctly matte-like rather than metallic. The blister copper is refined in the ordinary way. Copper made from matte, from which the As and Sb have been eliminated thus in bottoms, is in many places technically called "best selected."

2. *Matte containing Ag but neither Au, As, nor Sb.*—In case the residues from the hot-water leaching yield on smelting a matte rich enough in Ag, this matte is again treated by the Ziervogel or Augustin process, and the resulting residues are "roasted" and refined without separating bottoms.

3. *Matte containing Ag and either Au, As, or Sb.*—If the residues from the first Ziervogel operation yield on smelting a matte containing enough Ag to pay the cost of extraction, and also any important quantity of either Au, As, or Sb, this is roasted so as to yield one or two sets of bottoms, as just described. The bottoms are specially treated for Au (by parting with $H_2SO_4$, cupelling, or otherwise), and the pimple metal or regule from which they have separated is re-treated, often preferably by the Ziervogel or Augustin process, being kept separate from the leaner matte which is undergoing its first treatment by this process, (1) because one contains Au, while the other has already yielded its Au to the bottoms, and (2) because the relative proportions of Cu, Fe, and S are so different in the two mattes that they should be differently treated. The formation of bottoms in this case may serve any or all of three purposes, (1) to recover the Au, (2) to eliminate the As and Sb so that these elements will not interfere with the extraction of the Ag, or (3) to remove them so as to prevent their deteriorating the quality of the resulting copper. The residues are of course smelted and refined.

4. In case the matte contains neither Ag, Au, As, nor Sb, in important quantity, it is roasted and refined directly without either separating bottoms or lixiviation.

To sum up these four cases:

| If the resulting matte contains— | It is treated by— |
|---|---|
| Either Au, As, or Sb, but no Ag.. | Making bottoms, roasting, and refining the pimple metal without leaching. |
| Ag, but neither Au, As, nor Sb... | The Ziervogel or Augustin process, or both, the residues from this second leaching being refined without making bottoms. |
| Ag and either Au, As, or Sb ...... | Making bottoms, the pimple metal treated by the Ziervogel or Augustin processes, or both, the residues from which are refined. |
| Neither Ag, Au, As, nor Sb ....... | Roasting and refining direct, without making bottoms or leaching. |

## ADVANTAGES AND DISADVANTAGES.

§ 9. *The main advantages* of the Ziervogel process are—

(1) Its very small loss of Ag when pure mattes are treated, little Ag being left in the residues in this case, provided that the amounts of Fe, Cu, and S in the matte are properly proportioned, and that the operations are skillfully conducted: and, (unless As, Sb, or Zn is present), there will be but little loss from volatilizing, which is liable to be considerable in the Longmaid, Augustin, Patera, and other chloridizing methods, unless condensing towers are employed.

The losses are, however, probably heavier than in the Longmaid, and perhaps than in the Hunt and Douglas process, if we consider the losses incidental to the preliminary calcinings and smeltings of the ore in the Ziervogel process, and they become excessive if much As or Sb be present.

(2) The very trifling cost of reagents, hot water sufficing for a solvent, and the Cu used as a precipitant being recovered at slight cost.

(3) The Au is comparatively readily recovered.

(4) Though the plant is costly, if we include in it the furnaces needed for calcining and matting the ore, yet, since these form an almost necessary part of the plant of a large refining establishment, the extra plant needed to adapt such an establishment to the Ziervogel process is probably much less costly than that which the adoption of the Hunt

and Douglas or the Longmaid process would require, at least for ores yielding but a small weight of matte. The plant should ordinarily cost somewhat less than that of the sulphuric acid process, where the latter aims at the production of handsome crystals, and where equal quantities of materials of equal grades are treated; and it is almost identical with that of the Augustin process.

Its disadvantages are—

(1) The enormous consumption of fuel, a very expensive series of preliminary calcinings and smeltings being generally needed, since there are practically no ores which can be treated by this process without being first run into a rich matte. Here the process stands nearly on a par with electrolysis, the sulphuric acid and the Augustin processes, while the Hunt and Douglas and the Longmaid processes have an advantage in being directly applied to the ore. Further, as in the Augustin process, the calcination to render the silver soluble, as well as the extraction of the copper from the residues, requires a great expenditure of fuel.

(2) The very fine grinding, and the long, expensive, and very difficult and delicate calcination required to render the whole of the Ag soluble. The requirement that the chemical reactions shall progress uniformly throughout the different portions of the material operated on, and that nearly all the $CuSO_4$ must be decomposed and the Ag completely converted into $Ag_2SO_4$ without decomposing any of this unstable salt, renders this process one of the most delicate and difficult in the whole range of metallurgy.

(3) As in the Augustin and Patera processes, nearly all the As and Sb remain in the residue and contaminate the resulting copper. In this respect electrolysis, the Hunt and Douglas and the sulphuric acid processes, have the advantage in yielding copper free from arsenic and antimony, even in the case of impure materials.

Lamborn's hackneyed table, comparing the cost and efficiency of this and other processes at Mansfeld in treating very pure mattes, though quoted *ad nauseam*, is instructive enough to be reproduced here.

| Process. | Cost per cwt. Cu. £ s. d. | Percentage of silver left in the copper. |
|---|---|---|
| Liquation | 1 10 0 | 0.100 |
| Amalgamation | 16 6 | 0.059 |
| Augustin | 13 6 | 0.059 |
| Ziervogel | 7 6 | 0.029 |

For a further comparison of the advantages of this process with those of the Augustin process see § 17.

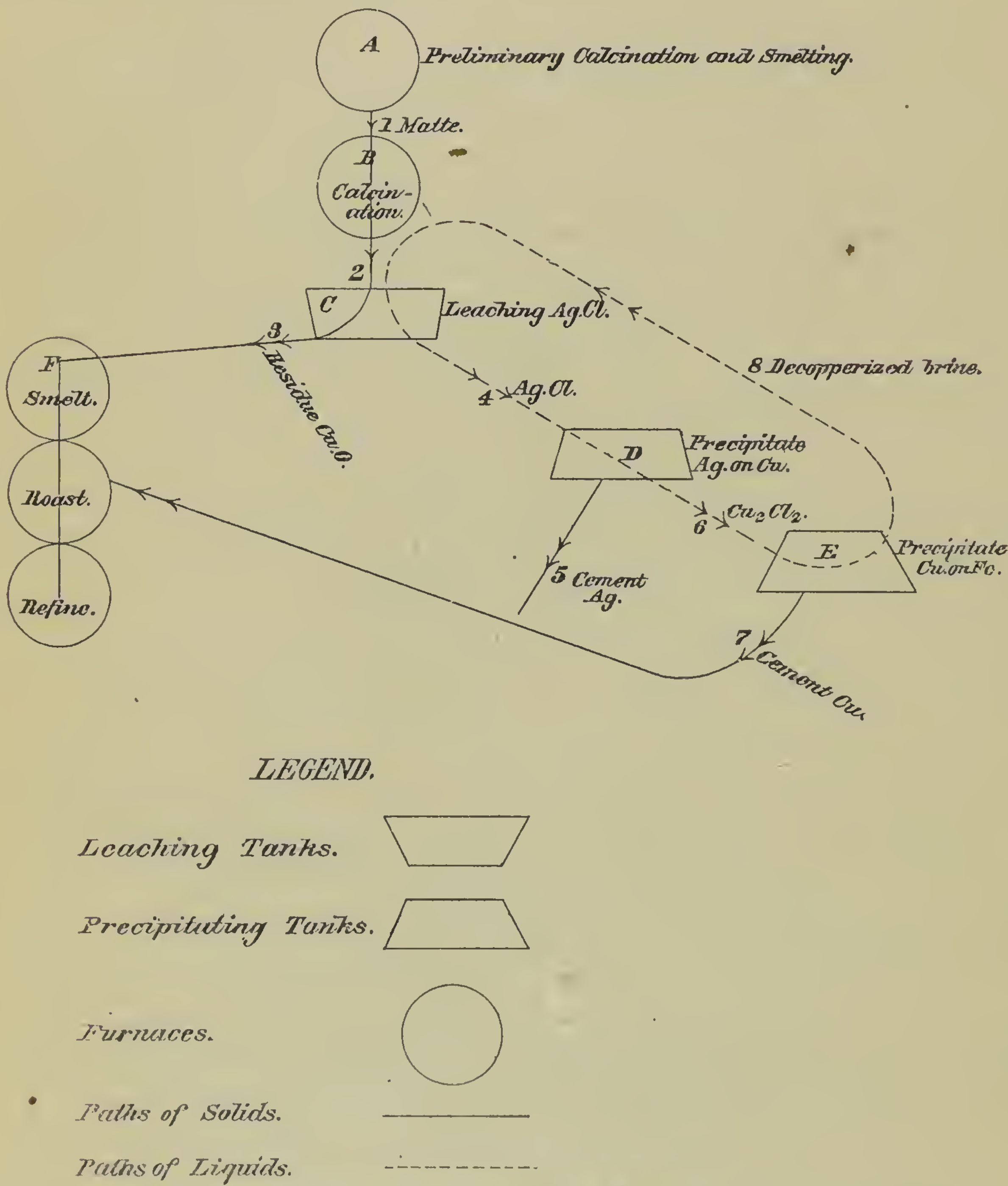
### APPLICABILITY.

From what has been said we see that this process is mainly applicable to pure materials, since As and Sb render the Ag insoluble, and Pb in considerable quantity causes the matte to cake in calcining, thus preventing the Ag from becoming thoroughly sulphatized. The products of smelting comparatively impure ores may, however, be sometimes advantageously treated by this process, either first removing the As and Sb by skillfully conducting the preliminary operations, and by concentrating and eliminating these elements in "bottoms," or by supplementing it with the Augustin process.

*En resume*, the process is especially applicable to copper mattes containing both Ag and Au, nearly free from As and Sb, and not containing much Pb, where fuel and refractory materials are cheap and very great skill attainables, and where water-power, and salt, iron, mercury, sulphuric acid, and other reagents are costly.

Pulverized black copper, mixed with pyrites or copperas, may be treated like matte.

These conditions will be most frequently found in large refining establishments; but even in these the sulphuric-acid process will probably be preferred where sulphuric acid is cheap and blue-stone salable, and electrolysis where water-power is available.



Tree illustrating the Augustin process.

## BASIS OF THE PROCESS.*

§ 10. The copper-silver-sulphur compound is calcined so as to produce insoluble CuO and soluble $Ag_2SO_4$; the latter is then chloridized with a little salt, leached out with brine (leaving the CuO in the residue), and its Ag then precipitated on metallic Cu. The process is based on the stability of the sulphate of silver at a temperature at which those of copper and iron are decomposed into insoluble oxides, and on the fact that when the silver of a matte has been nearly completely sulphatized the $Ag_2SO_4$ and small portions of still incompletely decomposed sulphides and of metallic silver arising from the decomposition of the sulphate are chloridized by calcining with salt.

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* See Kerl's Grundriss der Metallhüttenkunde, 1881, p. 349.

### GENERAL OUTLINE OF THE PROCESS.

It may be divided into the following heads:
*[A] Preliminary calcination and smelting, yielding a rich matte [2].
[B] Oxidizing followed by chloridizing calcination.
[C] Leaching out the Ag with brine.
[D] Precipitating the Ag on scrap Cu.
[E] Precipitating the Cu on scrap Fe.
[F] Extraction of the Cu (and Au if present) from the residues.

The rich argentiferous copper matte [I] produced by the preliminary calcining and smelting is calcined in reverberatories [B], without salt, till the Ag is converted into $Ag_2SO_4$, and the Cu and Fe into oxides. It is then calcined with salt, converting the Ag into AgCl, which is leached out with brine [8] in the tanks [C]. The residue [3] contains nearly all the Cu, and is refined after the necessary preliminary oxidizing fusions [F]. The solution [4] contains nearly all the Ag and a little Cu, together with considerable Pb and Zn, if those elements are present. The Ag is precipitated in [D] on metallic Cu; an equivalent of Cu being dissolved, which is precipitated in [E] on scrap iron. The solution [8] from which the Cu has been precipitated is used for leaching fresh portions of matte; the $FeCl_2$ it contains is removed by precipitating the Fe as oxychloride by exposing it to the air; the $Na_2SO_4$, which gradually accumulates, is occasionally crystallized out.

This process closely resembles the Ziervogel, the main difference being that in the Augustin the $Ag_2SO_4$ formed in the calcination is dissolved as AgCl, while in the Ziervogel it is dissolved as $Ag_2SO_4$. In each case the soluble silver salt is precipitated on scrap Cu, and the Cu thus dissolved in turn on Fe; while the Fe and Cu contained in the matte are left in the insoluble residue. Most of the remarks made in the description of the Ziervogel process apply to the Augustin.

### [B] OXIDIZING FOLLOWED BY CHLORIDIZING CALCINATION.

§ 11. The first or oxidizing part of the calcination is conducted in almost exactly the same way as is the calcination for the Ziervogel process, and is controlled by the same tests. The reader is therefore referred to the description of that process in § 4. When the calcination has reached the point at which the $CuSO_4$ is nearly all decomposed in the Ziervogel process, it is in the Augustin process mixed with from 1 to 6 per cent. of salt. according to the amount of sulphates it contains.

If the salt were charged alone on the hot matte, it would melt before the workmen, be they ever so dexterous, could mix it thoroughly into the charge; once melted it would be impossible to completely mix it. This difficulty is met in two ways: either the matte is drawn from the furnace, reground, and mixed while cold with the salt, or else the salt is mixed with a portion of previously roasted cold matte, say with 40 parts of cold matte for each 100 parts of matte in the original

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* The letters and figures in brackets refer to the accompanying tree.

charge. This mixture is rapidly spread over the still hot matte without drawing it from the furnace, the large proportion of cold matte intimately mixed with the salt preventing the latter from melting before it has been uniformly mixed through the whole mass.[*] After adding the salt the matte is calcined for from fifteen to forty-five minutes at a very low temperature, to avoid volatilizing and even melting AgCl, which fuses at about 260° C and is very difficult to dissolve after fusing. For the same reason it is important to draw the charge the moment that the Ag is completely chloridized. Steam is often admitted into the furnace during the calcination.

### CHEMISTRY OF THE CALCINATION.

§ 12. The aim of the oxidizing calcination, precisely like that of the Ziervogel process, is to wholly convert the Ag into $Ag_2SO_4$ by the $SO_3$ evolved from the decomposition of the sulphates of Cu and Fe previously formed, whose decomposition should be made as complete as possible. The chemical principles are almost identical in the two cases. To avoid repetition the reader is referred to the discussion of the chemistry of the Ziervogel calcination, § 5.

The addition of the salt is to convert into soluble chloride the Ag existing as arseniate, antimoniate, sulphide, and metallic silver, all insoluble in the hot water employed in the Ziervogel process. The salt, of course, incidentally chloridizes the already soluble $Ag_2SO_4$, on which it reacts by double decomposition very rapidly. $Ag_2SO_4 + 2NaCl = Na_2SO_4 + 2AgCl$. It reacts more slowly on the arseniate and antimoniate of silver, yielding AgCl and antimoniate and arseniate of soda. The latter compounds react partially on the AgCl in the subsequent leaching operation, reprecipitating arseniate and antimoniate of silver in the residues, as explained in [C]. Any small portions of metallic Ag present, and of not quite completely decomposed $Ag_2S$, are at least partly chloridized.[†] This power of chloridizing small portions of Ag and $Ag_2S$, which are wholly lost in the Ziervogel process, and whose presence can only be avoided by the greatest skill and care, by grinding the matte very fine and keeping the temperature and the oxidizing conditions very uniform—this power enables us in the Augustin process to obtain excellent results without such extremely fine grinding, and such exceptional skill and care as the Ziervogel process demands.

[There may be an additional explanation of the greater ease with which good results are obtainable in the Augustin than in the Ziervogel process. In the latter it is necessary to peroxidize $Cu_2O$ and FeO, since the lower oxides of their metals precipitate Ag from solutions of $Ag_2SO_4$. But as $Cu_2O$ does not precipitate Ag fromsolutions of AgCl, except in the presence of $CuSO_4$ and $FeSO_4$ (Percy, Metallurgy of Silver and Gold, I, p. 108), and as these sulphates should have been converted into chlorides by the calcination with salt, no reason appears *a priori* why the oxidizing calcination should be carried beyond the point where most of the $CuSO_4$ is decomposed (unless it be that the lower oxides of Fe, unlike $Cu_2O$, have the power of decomposing AgCl). If this be true, it should greatly lessen the difficulty of the calcination, since in the Ziervogel process probably the greatest difficulty and the greatest danger of decomposing the $Ag_2SO_4$ arises from having to peroxidize the Cu and Fe. I have been unable to obtain positive information on this point.]

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[*] Egleston states (Trans. Am. Inst. Min. Eng, IV, p. 295) that Professor Hill, at Black Hawk, Colo., in treating the residues from the Ziervogel process by the Augustin process, charges 1 per cent. of salt alone directly on the hot calcined residues without removing them from the furnace.

[†] It is generally stated that all the metallic Ag formed in calcining is necessarily lost. Percy, however, found that Ag was rapidly chloridized by salt at a temperature sufficient to melt that substance (Percy, Metallurgy of Silver and Gold, I, p. 70). HCl at a red heat and Cl even at the ordinary temperature convert Ag into AgCl, and both these gases are almost inevitably evolved in calcining with salt. According to Moesta (*loc cit.*, p. 85), AgCl is formed when $Ag_2S$ is heated with salt in presence of steam (which is almost always present in the products of combustion), the reaction taking place (though slowly) even at 100° C. Cl gas, even at the ordinary temperature (*loc. cit.*, p. 41), converts $Ag_2S$ into AgCl.

If, as in the Longmaid process, the salt were charged at the commencement of the calcination, in order to be sure of chloridizing our Ag we would have to add enough salt to chloridize not only it but also the sulphates of Fe and Cu (and of Zn and of Pb if present) formed during the earlier stages of the calcination, since they are greedily chloridized by the salt. Owing to the volatility of the chlorides of these metals and their power of dragging off AgCl, it would be necessary to employ condensing towers; the Fe and Cu chlorides would be dissolved in leaching along with the AgCl, and it would be necessary to reduce them to $FeCl_2$ and $Cu_2Cl_2$ before we could completely precipitate our Ag on scrap Cu. This in itself would be no easy thing, and even after accomplishing it we would be confronted with the difficult task of keeping a large mass of $Cu_2Cl_2$ in solution, which can only be done with large volumes of boiling brine, and even then with difficulty.

The presence of a large amount of $Cu_2Cl_2$ would prevent our escaping from this difficulty by precipitating the Ag from the mixed chloride solution with $ZnI_2$ (see § 23). And even if we avoided the difficulties attending the precipitation of the Ag by leaching the $CuCl_2$ and the iron chlorides with water before leaching our Ag with brine, we would still be put to the great expense of precipitating the enormous quantities of Cu thus dissolved as $CuCl_2$ on scrap iron, since the presence of large quantities of iron chlorides would prevent the use of lime as a precipitant. In brief, we would be carrying out the Longmaid process, which is not economically applicable to materials rich in copper, since the amount of costly scrap iron it requires as a precipitant increases in direct proportion to the amount of copper extracted, while the cost of smelting operations per ton of materials treated is comparatively little affected by their tenor in copper. Even if cheap water-power enabled us to escape from this last difficulty by precipitating our Cu by electrolysis, the enormous amount of salt which we would have to add to be sure of chloridizing our Ag would probably be fatal. Therefore we attempt, before adding salt, to decompose the sulphates of Fe and Cu as far as we can without decomposing much $Ag_2SO_4$ by too long and strong heat, so that we may chloridize the Ag alone, the oxides of the base metals resulting from the decomposition of their sulphates being but slightly chloridized by salt.

*Zn and Pb.*—Since $ZnSO_4$ is easily formed but difficultly decomposed by heat, though of course readily decomposed by salt, it is inevitable that Zn if present should become largely chloridized, necessitating the addition of an excess of salt for its chloridizing. Both the $ZnCl_2$ and the excess of salt it demands are so volatile and tend so strongly to drag off $AgCl_2$ that the presence of any large amount of zinc would make it impossible to use this process, unless condensing apparatus was employed. The presence of Pb is undesirable for similar reasons, though not so much so as that of Zn, since there is less danger of AgCl being volatilized by $PbCl_2$ than by $ZnCl_2$. Pb is also injurious in the precipitation, as explained in [D] § 14. Moreover, the fusible Pb compounds tend to form cakes and pellets so enameled that their interiors are inaccessible, and thus to check the calcination.

*Arsenides and antimonides* of silver are, as in the Ziervogel calcination, converted into antimoniates and arseniates. But while in the Ziervogel process the silver thus combined is lost, in the Augustin process it may be at least partly converted into AgCl. Indeed, even speisses have been successfully treated by this method, by calcining the residues with salt, and thus converting into AgCl those portions of silver which the first calcination failed to chloridize, as well as those which were chloridized but again precipitated as arseniates and antimoniates in leaching. Still the presence of these noxious elements is very prejudicial, as it necessitates a larger consumption of salt, increasing, both in this way and through the higher temperature and the greater length of time required to chloridize the arseniates and antimoniates of silver, the loss of silver by volatilizing; and, beyond this, the As and Sb contaminate the Cu resulting from the treatment of the residues. An obvious means of lessening the loss through volatilizing, and one which is (or at least was) carried out at the Boston and Colorado Smelting Works, is to leach out all the $Ag_2SO_4$, and $ZnSO_4$ if present, with hot water before charging the salt. Having now a very small portion of Ag left to chloridize we need but a comparatively small amount of salt to chloridize it—in itself an important saving. Further, we diminish the volatilizing of the AgCl, (1) because there is a very much smaller amount of Ag left to be volatilized; (2) because less salt will volatilize, since less is present, and the volatilizing salt always drags off Ag with it; and (3) because we have prevented the formation of $ZnCl_2$, which volatilizes readily, dragging off AgCl, by leaching out the $ZnSO_4$ before adding salt. This is, of course, combining the Ziervogel and Augustin processes, involving somewhat more handling of material, but effecting an important saving in salt and diminishing the loss of Ag. To avoid the loss of Ag which inevitably attends furnace chloridizing, attempts are made to chloridize it in the wet way with HCl, or with chlorides of Fe or Cu.

*Steam* is often used during the calcination. It probably mechanically lessens the loss from volatilizing, by dragging down the finely divided and suspended particles as it cools and liquefies, naturally condensing around minute particles of flue dust, which act as nuclei, and which are too light to settle by their own weight, but settle readily when even minute quantities of water have attached themselves to them. By diluting the air in the furnace steam may likewise favor the expulsion of As and Sb, by thus weakening the oxidizing tendencies, and so causing these elements to pass more slowly through their volatile conditions toward the fixed states of $As_2O_5$ and $Sb_2O_5$, and thus allowing a longer time in which they can volatilize. During the chloridizing calcination the steam favors the formation of HCl, and is said thus to favor the decomposition of arseniates and antimoniates.

### [C] LEACHING OUT THE AgCl WITH BRINE.

§ 13. Before leaching the matte is generally cooled, since it is said to cake if mixed with the brine while still hot. It is then sifted and the lumps returned to be reground and recalcined. The sifted matte is then leached in false-bottomed, tight wooden tanks with boiling brine and with the "final" liquor [8], from which Ag and Cu have been precipitated, for, say, twenty-four hours, the brine striking on a perforated disk of wood above the matte, to scatter it and to prevent its channeling the matte. To prevent "clotting" through the formation of anhydrous salts, the matte is sometimes moistened with brine before charging it in the leaching tanks. It is then charged into the tanks, which have already been half filled with brine.

[Cold saturated brine is sometimes preferred to hot brine, and the following advantages are claimed for it.* The extraction of the Ag is said to be as complete, while, since $SbCl_3$ and $PbCl_2$ are less soluble in cold than in hot brine, less of these elements dissolve, and thus a purer cement silver is obtained. The wear and tear of pumps, launders, and tanks is diminished, and the care and expense of heating the brine is avoided. Further, if the solution is effected by hot brine and the liquor is subsequently considerably cooled, $Na_2So_4$ and basic ferric salts are liable to separate out and cause great inconvenience. Other alkaline chlorides dissolve AgCl, as also do $CaCl_2$ and $FeCl_2$, the latter solvent being employed by Hunt and Douglass in their first patented process. It, however, dissolves Cu as $Cu_2Cl_2$ and $CuCl_2$ from any CuO contained in the matte, and would thus confront us with the perplexing problem of separating the mixed chlorides of silver and copper.]

The leaching with brine is continued till no precipitate of Ag is formed on a bright Cu blade held in the liquor [4] escaping from the leaching tank. The matte is then washed with water with which a previous lot of matte has been washed and then with pure water, the first washing being in some works concentrated so as to utilize the salt which it has dissolved out of the residue and the second washing being used to wash a subsequent lot of ore which has already been thoroughly leached with brine. The matte is then washed, say, twice more with pure water, preferably hot, to remove the salt as completely as possible, since this substance would cause loss of Cu in the subsequent smelting operations [F] by volatilizing. The thorough removal of the salt is imperative, though difficult.

The boiling brine dissolves the AgCl and the other metallic chlorides present. The arseniates (and to a certain extent the antimoniates) of soda (formed in the chloridizing calcination by the action of the salt on the antimoniates and arseniates of the heavy metals formed in the oxidizing portion of the calcination) are also dissolved and now react on the metallic chlorides, reproducing salt and arseniates and antimoniates of the heavy metals, which precipitate. Some Ag is inevitably precipitated in this way as arseniate and antimoniate, and thus lost in the residues, but probably by no means as much as would have been lost had the chloridizing calcination been omitted; that is, only a small portion of the arseniate and antimoniate of silver decomposed in the chloridizing is regenerated on leaching. Rivot states that the amount of Ag lost in the residues does not increase proportionally with the amount of As contained in the matte, while the proportion of As in the residue does.†

Since the chlorides of Fe and Cu interfere with the precipitation of the Ag, as explained in [D] § 14, while $PbCl_2$ debases the precipitated Ag, they may in considerable measure be removed by leaching the chloridized matte with hot water before dissolving the AgCl with brine. The hot water will dissolve $FeCl_2$, $Fe_2Cl_6$, $PbCl_2$, $CuCl_2$, $ZnCl_2$, &c., but only a little of the $Cu_2Cl_2$. Since AgCl is soluble in hot concentrated solutions of these chlorides, the solution thus obtained is removed to another tank and there diluted with water, when AgCl and some

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* Kerl, Grundriss der Metallhüttenkunde, 1881, p. 347.

† Principes Généraux du Traitement des Minérals Métalliques, Rivot, I, pages 412, 420, and 440.

$PbCl_2$, and perhaps a little $Cu_2Cl_2$, precipitate. This course should only be necessary in mattes containing considerable Pb, whose sulphate is difficultly decomposed; those of Fe and Cu are so comparatively easily decomposed by heat that no amount of their chlorides sufficient to cause serious trouble need in general be formed. If, however, the solution should contain much iron or copper chloride but no great excess of $PbCl_2$, we may use Hoffman's* plan of forcing hot water up through the matte from the bottom of the leaching tank before leaching with brine, and diluting the aqueous solution thus formed while it still remains in this same tank above the matte, when the AgCl (and $PbCl_2$ if present) will fall. The solution is now allowed to escape from the bottom of the tank, filtering down through the matte and there depositing the precipitated AgCl, but carrying off the chlorides of iron and copper. This method is simple, and lessens the number of tanks needed. The $CuCl_2$ dissolved in this preliminary leaching with water is precipitated on scrap iron along with the $Cu_2Cl_2$ contained in the desilverized solution [6].

A better plan still (if it be not too costly) is to combine the Ziervogel and Augustin processes, as already set forth in [B] § 12, by leaching out all the soluble sulphates with hot water before calcining with salt. All undecomposed $FeSO_4$ and $CuSO_4$ would be removed as such with the $Ag_2SO_4$, with whose precipitation they would not interfere. Then, when we come to chloridize the Ag remaining in the matte, since the Cu and Fe are present almost wholly as oxides, no considerable portion of them will be chloridized and subsequently dissolved, so that the precipitation of our AgCl will no longer be interfered with. This plan is the better of the two, because it is not only as efficient as the other in preventing base chlorides from interfering with the precipitation of the Ag, but it also economizes salt and lessens the loss of Ag by volatilizing, as explained in § 12.

### [D] PRECIPITATING THE Ag ON Cu.

§ 14. The argentiferous solution [4] now traverses two or more vats containing a checker-work of copper slabs, on which the Ag rapidly precipitates, a double salt of NaCl and $Cu_2Cl_2$ being formed. If $PbCl_2$ is present in the solution it is liable to precipitate.* The copper reduces any $Fe_2Cl_6$ and $CuCl_2$ present to $FeCl_2$ and $Cu_2Cl_2$. Indeed, the Ag cannot be completely precipitated until the whole of the $Fe_2C_6$ and $CuCl_2$ have been reduced.†

$$2AgCl + 2Cu = Cu_2Cl_2 + 2Ag.$$
$$CuCl_2 + Cu = Cu_2Cl_2.$$

Not only is it difficult and tedious to reduce a large quantity of $Fe_2Cl_6$ and Cu $Cl_2$, but keeping the reduced $Cu_2Cl_2$ in solution is very troublesome. Unless the liquor is kept very hot, and unless there is an excess of strong brine, the $Cu_2Cl_2$ precipitates in the most capricious and troublesome manner, becoming mixed with the precipitated Ag. Further, as the $FeCl_2$ and $Cu_2Cl_2$ would absorb O from the air, precipitating as oxychlorides and contaminating the Ag, it is necessary to keep the tanks [D] tightly closed; and the presence of $PbCl_2$ also makes it necessary to keep the liquor hot, since this salt is much more soluble in hot than in cold brine.

An atom of the precipitant metallic Cu is dissolved for each atom of Fe present as $Fe_2Cl_6$, and this Cu has to be precipitated again in [E], consuming scrap iron; half an atom of metallic iron being thus consumed for each atom of Fe existing as $Fe_2Cl_6$. This, with the contamination of the Ag with $PbCl_2$ and the inconvenience of having to reduce large quantities of $Fe_2Cl_6$ and $CuCl_2$ and of keeping the $Cu_2Cl_2$ in solution, shows how important it is to push the oxidizing calcination as far as possible (so as to decompose the greatest possible amount of sulphates of the base metals, and thus prevent their becoming chloridized) without decomposing much of the $Ag_2SO_4$. The precipitated Ag is washed with dilute hydrochloric acid to remove the base metals and their chlorides, then with pure water, is pressed, dried, and refined.

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* Kustel's Roasting of Gold and Silver Ores, 1880, p. 124, and Engineering and Mining Journal, 1883, II, p. 353.

† Rivot, *loc. cit.*, pp. 421 and 407.

### [E] PRECIPITATING THE Cu ON SCRAP IRON.

§15. Exactly as in the Ziervogel process, the now desilverized solution is treated with scrap iron, which precipitates its Cu. The precipitation of the copper from its chloride in this process and from its sulphate in the Ziervogel are so closely alike that the remarks made about it in the description of the latter process (§ 7) apply here with equal force, *mutatis mutandis.* I will here only insist on the importance of tightly closing the tanks and of keeping the liquors saturated with salt and very hot, to prevent the separation of unreduced $Cu_2Cl_2$, which separates out on the slighest provocation, remaining unreduced in the midst of the cement Cu, perhaps to be dissolved out and lost when the cement is washed, and perhaps remaining to volatilize and thus escape when the cement is melted. While it is possible that the Cu might be recovered by milk of lime instead of metallic iron, further investigations are probably needed to enable us to speak with certainty on this point, since the conditions are much complicated by the fact that the "final liquor," which if lime were used would contain not only much $CaCl_2$, but also some CaO, has to be indefinitely re-used in leaching fresh portions of matte.

The coarser portions of the cement copper are used for precipitating fresh portions of Ag; the finer portions are at once smelted to blister copper.

The "final liquor" from which the Ag and Cu have been precipitated contains some iron chlorides and much salt. If we attempted to utilize its salt by returning it to leach fresh portions of matte, the $FeCl_2$ it contains would attack and dissolve a large amount of CuO as $Cu_2Cl_2$ and $CuCl_2$, both of which would be inconvenient in the precipitation of the Ag, as we have already seen, while the Cu thus dissolved would have to be precipitated, consuming much scrap iron. This difficulty is met by exposing the final liquor to the air, by heating in shallow tanks or otherwise, when the Fe almost completely separates as oxychloride. The brine thus purified is used, after adding a little salt, for leaching fresh portions of matte, being occasionally concentrated to crystallize out the $Na_2So_4$ which necessarily accumlates.

### [F] TREATMENT OF THE RESIDUES FOR Cu AND Au.

§ 16. The treatment of the residues is identical with that of the residues from the Ziervogel process, and the reader is accordingly referred to the somewhat extended discussion of the subject in the description of that process in § 8. It is only necessary to repeat that the residues should be very thoroughly washed to remove all salt, since any which remained would cause copper to volatilize as chloride in smelting.

## ECONOMIC FEATURES.

§ 17. Since CaO, MgO, Pb, Zn, As, and Sb either seriously interfere with this process or prevent its application, it is, as in the Ziervogel process, in general necessary to concentrate the Ag into a rich Cu matte by preliminary calcinings and smeltings, which will eliminate some of these detrimental substances completely and the rest partly. Where fuel is costly this places the process at a serious disadvantage compared with the Longmaid and the new Hunt and Douglas processes, which are directly applied to the ore without previous smelting.

As compared with the Ziervogel process, the Augustin probably has the advantage, at least when As or Sb is present, of more completely extracting the Ag from the residues, and this advantage probably increases with the proportion of As and Sb, since an increase in the percentage of these elements apparently increases the amount of arseniate and antimoniate of silver contained in the residues much more in the Ziervogel than in the Augustin process. Per contra, the loss of silver and copper by volatilizing, quite small in the Ziervogel process, is liable to be considerable in the Augustin, and this loss is much increased by the presence of Zn, the very volatile ZnCl dragging off the chlorides of Ag and Cu, and by the presence of As and Sb, which require a hotter and longer calcining. Thus we may say that the relative advantages of the Augustin probably increase with the percentage of As and Sb, while those of the Ziervogel increase with the percentage of Zn. But even this advantage of the Ziervogel may be greatly lessened by condensing the volatilized chlorides of the Augustin in a gossage tower. Beyond this, the Augustin labors under a disadvantage in the consumption of salt and in the prolongation of the calcination for chloridizing, but it has a partly compensating advantage in not requiring such very fine grinding or such exceptional skill and care in the calcination. But by combining the Ziervogel and the Augustin processes, as explained in [B] and [C], §§ 12–13 above, we greatly diminish the consumption of salt, the loss of Ag and Cu by volatilizing, even with zinciferous mattes, and the difficulties caused by $Fe_2Cl_6$ and $Cu_2Cl_2$—the disadvantages of the Augustin process—while we retain its advantages of more completely removing the Ag from the residues and of not needing such extraordinary care and skill as the Ziervogel process does.

In treating pure materials the loss of Cu is small and that of Ag is very small, sometimes less than 6 per cent. With impure materials the loss of Ag is heavy, and repeated calcinations and leachings may be needed. Moreover, As and Sb, if present, are almost completely left in the residues, contaminating the resulting copper, from which their removal is difficult, costly, and incomplete. Here again electrolysis, the Hunt and Douglas and the sulphuric acid processes have a great advantage over it, since in them the Cu is obtained nearly free from As and and Sb.

From Kerl's figures* I have calculated the following table of the consumption of materials in treating 1 ton of matte, say 65 per cent. copper and 0.24 per cent. silver.

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* Crooke's and Rohrig's Adaptation, I, p. 373. The consumption of coal for the chloridizing calcination seems excessive.

*Materials consumed at Freiburg in treating* 1 *ton of matte by the Augustin process.*

| Treatment. | Tons coal. | Tons salt. | Tons scrap iron. |
|---|---|---|---|
| Oxidizing calcination | 0.66 | ........... | ........... |
| Chloridizing calcination | 0.51 | 0.054 | ........... |
| Leaching and precipitating | 0.38 | 0.066 | 0.0097 |
| Treating the residues | ........... | ........... | ........... |
| Calcination | 0.113 | 0.005 | ........... |
| Leaching | 0.033 | 0.005 | 0.0006 |
|  | 1.696 | 0.130 | 0.0103 |

Here 9.288 per cent. of the Ag and 3.23 per cent. of the Cu were lost.

### ADVANTAGES AND DISADVANTAGES.

To sum up, the main advantages of the Augustin process are—

(1) That in mattes free from Zn, but containing small portions of As and Sb, the loss of Ag is probably less than in the Ziervogel process, though still liable to be heavy.

(2) That, as compared with the Ziervogel process, it requires less fine grinding and less exceptional skill.

(3) That, while the plant is decidedly costly per unit of capacity, if we include in it the furnaces needed for the preliminary calcinings and smeltings, yet, since these form an almost necessary part of a general smelting and refining establishment, the increase of the plant of such an establishment required for introducing the Augustin process is smaller than for introducing the Hunt and Douglas or the Longmaid process, at least when the ore yields but a small weight of matte. The plant required is almost identical with that of the Ziervogel process, but probably less costly than that of the sulphuric-acid process, where the latter aims at the production of fine crystals.

(4) The gold is comparatively readily recovered.

Its disadvantages are—

(1) That requires a generally expensive series of preliminary calcinings and smeltings, since it is not directly applicable to the ore, except possibly in rare instances. Furthermore, the extraction of the Cu from the residues requires a heavy consumption of fuel.

(2) That it requires a long, delicate, and expensive calcining, perhaps more expensive even than that of the Ziervogel process, though less delicate.

(3) The loss of Ag and Cu, at least when As, Sb, or Zn is present, is heavier than in electrolysis or in the sulphuric-acid process, and (except in the case mentioned above of mattes free from Zn but containing small amounts of As and Sb) than in the Ziervogel; and heavier than the Longmaid, and probably than in the Hunt and Douglas processes, if we include the losses which take place in the preliminary calcinings and smeltings of the Augustin process.

(4) That nearly all the As and Sb remain in the residue and contaminate the resulting Cu.

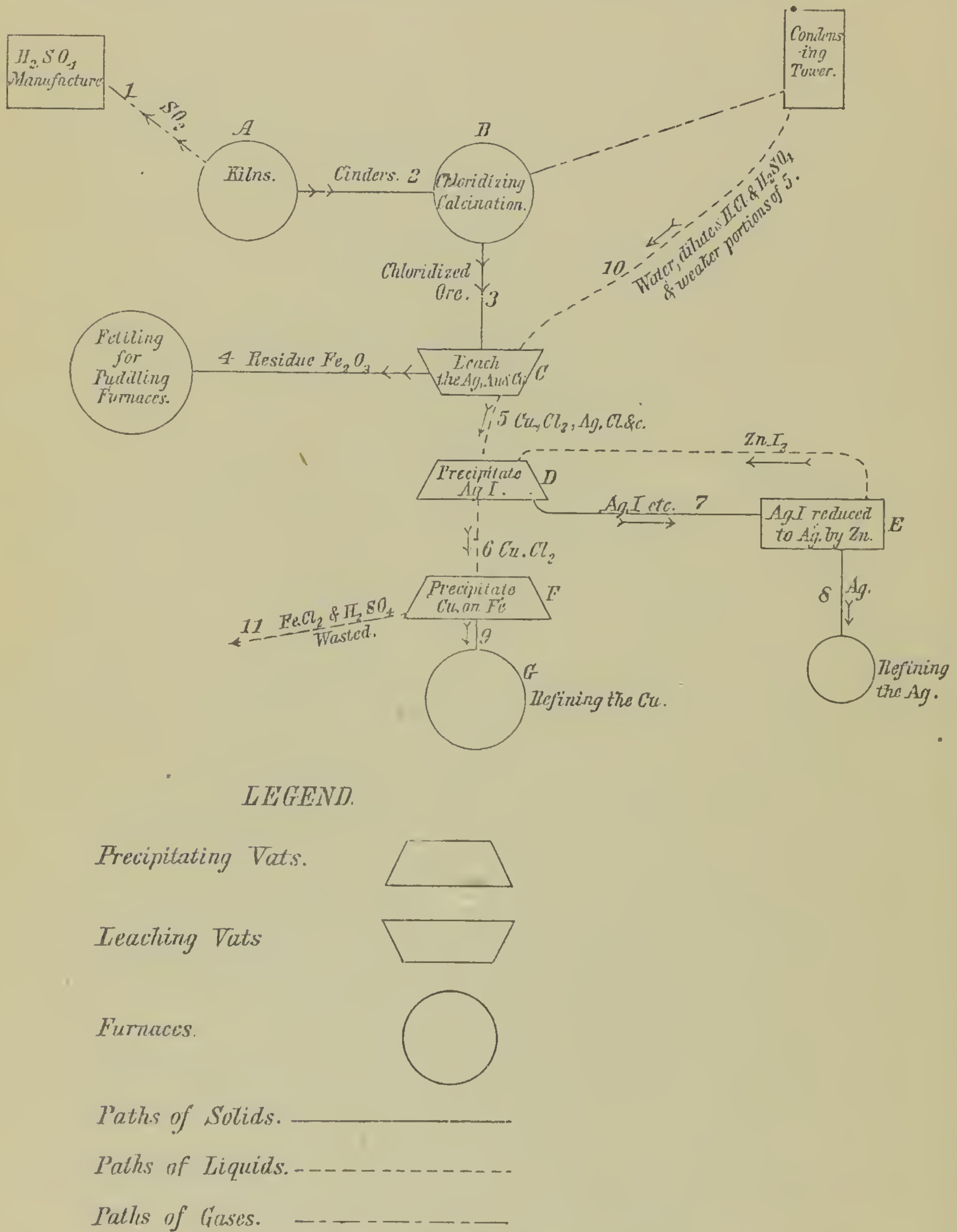
(5) That it requires a considerable consumption of salt.

By combining it with the Ziervogel process the third and fifth of these objections are greatly mitigated.

### APPLICABILITY.

From what has been said we can see that the Augustin process is chiefly applicable to copper mattes containing little if any As and Sb and no great quantity of Zn or Pb; where fuel and refractory materials are cheap and great skill is attainable; and where iron, sulphuric acid' and water-power are dear. It is also particularly desirable for treating the residues of the Ziervogel process, especially in the case of mattes containing small quantity of As and Sb. It is also applied with slight modifications to black copper. These conditions will be most frequently found in central refining establishments; but in these it will probably be less desirable than the sulphuric-acid process if sulphuric-acid is cheap and blue-stone salable, and less desirable than electrolysis if water-power be available.

## THE LONGMAID (HENDERSON) AND CLAUDET PROCESSES.*



Tree illustrating the combined processes.

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*See Elements of Metallurgy, John Arthur Phillips; Sulphuric Acid and Alkali, Lunge, I, p. 625; Chem. News, XXIII, p. 26, and XXXI, p. 165; Wagners Jahresbericht, 1872, p. 152; Dingler, CCIV, p. 288, CCXIV, p. 466, CCXV, pp. 54 and 229, CCXIX, p. 323, CCXXXI, p. 323; Zeit. B. H. & Sal., 1877, p. 156.

### BASIS OF THE PROCESSES.

§ 18. Longmaid's process, to which Henderson's name appears to have been unjustly attached, is based on the fact that when small portions of gold, silver, and sulphate oxide and sulphide of copper are calcined with salt and a great excess of iron oxide, they are rendered soluble as chlorides. Claudet's beautiful process separates the Ag and Au from the mixed chloride solution by precipitating them with $ZnI_2$, AgI being almost wholly insoluble in the liquors employed. The two processes are here described together as a single method, because it is in practice frequently desirable to combine them, although each in special cases may be more advantageously combined with some third method.

Many other methods of separating the mixed chlorides have been proposed, some of which are described in section 24. None of them have attained anything like the success of Claudet's process.

### GENERAL OUTLINE.

The process may be conveniently divided into the following heads:

*[*A*] Burning the ore, preferably in kilns.

[*B*] Calcining the burnt ore [2] with salt.

[*C*] Leaching out the Cu, Ag, and Au with hot water and dilute HCl and $H_2SO_4$ (tower liquors).

[*D*] Precipitating the Ag and Au with $ZnI_2$ and KI.

[*E*] Reducing the Ag and regenerating the $ZnI_2$.

[*F*] Precipitating the Cu on scrap iron.

[*G*] Washing and refining the precipitated Cu.

After being crushed so as to pass through holes 3 inches square, the ore is burnt, preferably in kilns [*A*], yielding $SO_2$ [1], which may be used for the manufacture of $H_2SO_4$, and burnt ore or "cinders" [2] containing about twice as much S as is needed to combine with the Cu present to form $CuSO_4$. The cinders [2] are calcined in reverberatories [B] with 10 to 20 per cent. of salt, at a low temperature and with frequent stirring, till nearly the whole of the Cu is converted into chloride and oxide. They are then immediately drawn and preferably allowed to cool slowly in heaps. The gases evolved in calcining are condensed to a weak acid solution [10] which is used to remove the CuO and $Cu_2Cl_2$ formed in calcining. The chloridized ore, [3] is leached in [C] with weak liquors from previous washings, with water, and with the weak acid solution [10] called tower liquors, yielding [4] residues of nearly pure $Fe_2O_3$ (generally used for fettling), and a solution [5] containing nearly all the Cu, Ag, and Au originally present in the ore. The first three washings of [5] contain 95 per cent. of the soluble Ag. They are clarified by decantation, and the Ag then precipitated as AgI by $ZnI_2$ and KI, the Au falling with the AgI. The AgI is reduced to Ag by Zn, regenerating the precipitant $ZnI_2$, and sent to the silver refineries. From the desilverized liquors [6] and from any other portions of solution [5] rich enough in Cu this metal is precipitated on scrap iron, yielding cement Cu [9], which is refined, and a solution rich in $FeCl_2$ and $Na_2SO_4$ which is generally run to waste. Those parts of [5] not rich enough in Cu for precipitation are enriched by leaching fresh portions of ore.

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* The letters and figures in brackets refer to the accompanying tree.

## [A] BURNING THE ORE.

§ 19. Naturally oxidized ores are at once calcined with salt, "burning" being of course impossible. But by far the greater part of the ores suited for the Longmaid process must be burned before the chloridizing calcination, the success of which demands that the ore should be previously almost completely desulphurized, not more than 1.5, nor less than 1 part of S to each part of Cu being permissible in the burnt ore or "cinders." A deficiency of S may be met by adding raw or imperfectly desulphurized pyrites. To effect this thorough desulphurizing, kilns* are almost if not quite indispensable for lump-ore, since they alone permit the exact regulation of the temperature and the quantity of air admitted which is demanded. In burning in piles it is inevitable that some portions of the pile shall be so cool that the combustion of the S is not complete, and that some $FeSO_4$ and $CuSO_4$ escape decomposition; while in others a deficiency of air combined with high temperature cause the formation of clinkers or "scars" of FeS, a compound at once very fusible, difficultly oxidizable after fusion, and formed whenever pyrites is heated with a deficiency of air. In both these ways S is retained in the pile-burnt ore, which would generally have to undergo an additional oxidizing calcination in reverberatories to remove the excess of S before commencing the chloridizing calcination proper. Even in cases where extreme skill and care enable us to thoroughly desulphurize the ore in pile burning, local overheating is very liable to frit the ore, or at least to bring some of it into a condition in which its subsequent chloridizing is very difficult. The greater cost of calcining pile-burnt ore generally far more than compensates for the slightly greater cost of burning in kilns than in piles, even if we leave out of consideration the interest charges due to tying up large quantities of ore for the 6 to 12 weeks required for pile burning.

Fine ore requires special treatment, and, if it amounts to more than 7 to 8 per cent. of the lump ore or "roughs," a special apparatus.

*Crushing the ore.*—It is crushed so as to pass through a screen with holes varying in different establishments from 1.25 to 3 inches square. Ore fine enough to pass through 0.5-inch (or in some places 0.25-inch) holes is set aside for special treatment. It is very important to have the ore broken to a proper size, which varies somewhat with different ores, since, if the lumps are too large, they cannot be completely desulphurized in their centers, while if too small they block up the air passages, and the oxidizing action becomes so weak that FeS forms and fuses, creating scars. To diminish the proportion of fines it is sometimes desirable to break the ore by hand instead of by machine, especially in the case of very soft and friable ores, in which hand-breaking diminishes the proportion of fines much more and increases the cost of the operation much less than in the case of hard ores.

*Kiln-burning.*—The kilns (Fig. 1) are essentially nearly rectangular brick chambers, about 6 feet high and 4 feet 6 inches by 5 feet 8 inches inside, with tightly fitting brick-lined iron fronts, which are each provided with an ash-pit door (*a*), an intermediate door (*b*) for stirring the ore, and a charging door (*c*) near the top. At from 16 to 24 inches from the bottom and covering the ash-pit a grate (*d*) extends across the whole area of the kiln, with movable bars, sometimes toothed or grooved to facilitate shaking down the ore. On this grate is maintained a body of ore reaching to the upper or charging door, and from 16 to 30 inches thick according to the richness of the ore in Cu and S.

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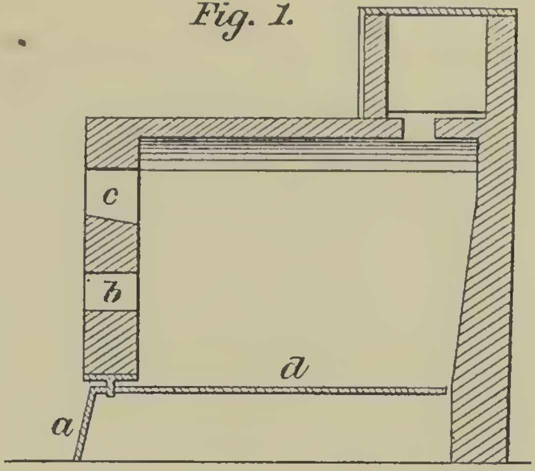
* For an exhaustive description of burning pyrites in kilns, see Lunge's Sulphuric Acid and Alkali, I, p 147, on which and the writer's personal experience the following remarks are mainly based.

*Fig. 1.*



On starting a kiln it is filled with burnt ore or broken stones from the grate to the charging door. On this a fire is kept till the surrounding walls and the top of the burnt ore are red hot, when the fire is drawn and raw ore charged, which immediately takes fire. At stated intervals the grate-bars are shaken so as to allow part of the ore immediately above them to drop through, fresh ore being then charged on the body of partly desulphurized ore remaining in the kiln. The combustion of the S and Fe of the pyrites easilys upplies an amount of heat equal to that lost by radiation and conduction, so that no fuel is required. Thus the process goes on continuously, repairs being needed only at very long intervals.

*Details of the operation.*—Every twelve or every twenty-four hours each kiln is charged with fresh ore, the surface after charging being about 2 inches higher at the back and sides than at the front, with a uniform slope. Immediately after the lump-ore from 7 to 8 per cent. of fines may be charged along the sides and back of the kiln. This is to check the tendency of the air to draw up in greater proportion along the smooth walls than through the center of the ore. The top of the ore is now nearly black, and but little air is admitted until it has pretty generally caught fire; soon blue flames of S appear on the surface of the ore and a little more air is now admitted, but it is again shut off when the blue flames decrease, indicating that much of the S has been burnt off. The ore is now red hot, but it gradually cools till a strong glow is only produced by stirring it. About two hours before recharging the kiln the upper part of the ore is carefully raked over to remove or break up any clinkers or scars which may have formed, as it is very important that they should not be allowed to descend, since they would accumulate on the grate and eventually block it up completely. Should blue flames appear on thus stirring the ore, indicating that an undue amount of S remains, more air must be admitted. As soon as the ore is so far cooled down that streaks made with brimstone on the charging door will not take fire, the doors are tightly closed and the grate bars moved so as to shake the ore down evenly, and to pass the equivalent of a charge into the ash-pit. The kiln is now immediately recharged with fresh ore, and the operation goes on as before.

It is very important that the ore should not be shaken down and fresh ore charged till the portion last charged is so far desulphurized that there is no longer any danger of its fusing. Clinkers which form near the upper surface are easily removed, but those formed at a considerable depth are only removed through the overlying ore with great difficulty.

In burning, two points are to be especially kept in view, (1) to maintain such an excess of air and to keep the ore so cool that FeS will not form and fuse; (2) to keep the temperature high enough to almost completely decompose the $FeSO_4$ and $CuSO_4$, and to avoid cooling the kiln below the point of ignition of the pyrites. The latter trouble, easily avoided except with pyrites lean in S and therefore unfitted for the Longmaid process, is generally due to not charging enough ore to keep up the heat, and to keeping too thin a body of ore on the bars, though sometimes to admitting so great an excess of air as to unduly lower the temperature, and occasionally to too completely excluding the air and thus smothering the fire.

There is far greater danger of the ore's getting too hot, which may arise (1) from employing too large charges of ore; (2) from charging too often; (3) from keeping too thick a bed of ore on the grate; (4) from shaking the ore down too soon; and (5) from not admitting a sufficient excess of air, be it on account of insufficient draught, from closing the doors too tightly, or from blocking up the air passages with scars or with an excess of fines.

The temperature may be roughly ascertained by feeling the front of the kiln, which should be so hot just below the charging door that one's hand cannot be held against it, while immediately above the grate it should be only blood-warm.

Overheating is met by retarding and diminishing the charges, by concentrating them along the back and sides of the kiln, by admitting more air,* and in some cases by removing some of the ore and allowing it to cool before recharging it. Undue cooling is met by increasing the charges, by admitting less air (unless the cooling is due to imperfect draft and scars choking the fire), by removing scars, and, if necessary, by charging hot ore from other kilns.

Irregularity in working, resulting in incomplete desulphurizing and in the accumulation of scars, must be carefully guarded against by breaking the ore to a nearly uniform and suitable size, by conscientiously breaking up scars and preventing their descending to the grate, by shaking the grate-bars evenly, and by maintaining a regular sloping surface.

Overheating must be especially guarded against in ores rich in S and Cu. Cupreous ores are more fusible than pure pyrite, while in ores lean in S, and therefore containing much gangue, the dissemination of the gangue through the mass of the pyrites mechanically hinders the ore from running together and forming clinkers. Moreover, the presence of this inert gangue drags down the temperature, by increasing the quantity of material to be heated without increasing the evolution of heat. Therefore in ores lean in S and Cu we may drive the kilns more rapidly than in richer ores, charging more ore and keeping a thicker bed of ore on the grate. Increasing the thickness of the bed of ore means more thoroughly heating the air as it passes up to the fresh and burning ore near the upper surface, thus increasing the temperature developed there, regenerating and returning to the burning ore the heat which in a shallow kiln would be lost by removing the cinders while still hot, or by conduction from the bottom of the ash-pit.

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* The writer has suggested that, where the manufacture of $H_2SO_4$ is not aimed at, steam, or preferably the products of combustion of the furnaces of the establishment, should be introduced into the kilns along with the air. Steam or inert N CO and $CO_2$, by increasing the amount of matter to be heated by the combustion of the S and Fe, would enable us to burn more of these elements in a given time (*i. e.*, to run our kilns faster), without reaching a dangerously high temperature. The amount of air admitted affects the temperature very much as it does in burning a thin bed of coal. There is a certain quantity of air which produces the maximum temperature; either increasing or diminishing the admission of air from this point will lower the temperature. Under ordinary conditions in pyrites burning the amount of air admitted seems to be above that which would produce the maximum temperature, so that increasing the quantity of air carries us further away from the maximum temperature and cools the kiln, and *vice versa*.

My own experience has been that increasing the area of the grate does not sensibly diminish the output of the kiln per square foot of grate surface, while it greatly lessens the cost of construction per unit of output. The following table gives some data as to the capacity per square foot of grate per 24 hours for different grades of pyrites:

*Table showing the capacity of pyrites kilns.*

| Kind of pyrites. | Per cent. of sulphur. | | Pounds per square foot, per 24 hours. | Pounds per kiln, per 24 hours. | Authority. |
|---|---|---|---|---|---|
| | In the ore. | In the cinders. | | | |
| | 48 | | 30 | 787 | Lunge |
| | 40 to 42 | | 35 | 900 | Do. |
| | 38 to 40 | | 40 | 1,012 | Do. |
| Westphalian | 41 to 42 | | 50 to 64 | | Bode. |
| Norwegian | 41 to 42 | | 38.3 | | Do. |
| Davis (Mass.) | 49 | 3 | 32 | 800 | Merrimac Chemical Company. |
| Capelton (Canada) | 40 | 4.5 | 49 | 1,000 | Private communication. |
| Do.* | 40 | 4 0 | 7.1 | 2,000 | Do. |
| Davis (Mass.)* | 49 | 4. | 4.6 | 1,300 | Merrimac Chemical Company. |

* With the Maletra or Schaffner shelf-kiln.

The writer has burnt far greater quantities of pyrites per square foot of grate than those given above for smelting purposes, for which a much less complete desulphurizing is required than for the Longmaid process.

*Fines.*—If the fines do not amount to more than some 8 per cent. of the total they can be burnt by spreading them along the back and sides of the kiln after charging the lump ore. If they exceed this proportion they may either be burnt in a special apparatus, or ground to a paste with water in a pug mill, and dried on the tops of the kilns, when, thanks to the formation of basic-ferric sulphates, they form cakes so coherent that they may be treated like lump ore. The fines of some ores (*e. g.*, those of Ely) form solid cakes by simple exposure to the weather without special grinding.

Balling with clay is not desirable, since the balls soon disintegrate in the kilns, and since the clay interferes with the chloridizing of the cinders, as well as with the desulphurizing.

Though Gerstenhofer's kiln* appears to be the best apparatus for burning fines where complete desulphurizing is not needed, and to be especially adapted to burning copper matte, Schaffner's modification of Maletra's* shelf-kiln seems far better fitted for preparation for the Longmaid progress. This has 7 horizontal fire-clay shelves, each reaching from side to side of the kiln, but each a little shorter than the kiln; they are staggered so that there is a space left on alternate shelves between the shelf and the front of the kiln and between the shelf and the back of the kiln respectively. The ore is charged in lots of 250 pounds on the upper shelf, and at stated intervals of about four hours the charge on each shelf is raked through these spaces on to the next lower shelf and there spread out, when a fresh charge is introduced on the top shelf. The increased output per kiln renders the cost of construction of this burner per unit of output not much greater than in lump kilns.

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* Engineering and Mining Journal, 1883: I, p. 252; Lunge's Sulphuric Acid and Alkali, I, p. 215–219. Kerl, Grundriss der Metallhüttenkunde, 1881, p. 146.

There are several other good burners for fines, but they have not met with such favor as have Maletra's. Among these may be mentioned Spence's and O'Harra's,* in which the ore is drawn along the hearth of a reverberatory by a traveling rake or rings, and Hasenclever and Helbig's vertical series of zigzag shelves, with parallel horizontal edges, each shelf dipping 45 degrees, but alternately in opposite directions, so that the upper edge of each shelf is within a few inches of the lower edge of the next higher one. The ore piles itself at its angle of repose on these shelves, forming thin layers on them. As it is gradually drawn from the bottom of the lower shelf, the whole mass of ore slides downward along the series of shelves. MacDougall's beautiful mechanical burner also deserves notice. It has a vertical series of 7 horizontal circular shelves, which have alternately circumferential and central holes, through which the ore drops from shelf to shelf. A vertical central shaft revolves, carrying 7 horizontal arms, one in contact with the ore on each shelf, with teeth so placed as to stir the ore and move it gradually centrifugally on those shelves with circumferential holes and centripetally on those with central holes, so that the ore passes slowly but continuously over the series of shelves, finally escaping from the lower one. With the exception of O'Harra's and Spence's, which require fuel, in all the above furnaces the heat developed by the pyrites maintain the temperature, no fuel being needed.

It is unlikely that revolving cylinder furnaces can desulphurize the fines thoroughly enough for this process, since, at least during certain stages of the burning operation, the ore is so plastic that the fine particles on falling become welded into pellets, whose shells become so compact from the repeated impacts that they prevent the air from penetrating to their interiors. Even in cases where the S has been satisfactorily removed in cylinder furnaces, the subsequent chloridizing of the Cu has been found very difficult, probably owing to the particles of ore being rendered too compact by the repeated blows; both for thorough desulphurizing and thorough chloridizing even the fine particles must remain open and porous.

For similar reasons and on account of the shortness of the oxidizing exposure the Stetefeldt furnace is probably inapplicable.

### [B] THE CHLORIDIZING CALCINATION.

§ 20. The cinders, mixed with 10 to 20 per cent. of salt (15 per cent. may be taken as a fair average), are crushed so as to pass through a screen of about 8 meshes per linear inch. Many prefer to allow the crushed mixture to stand several weeks before calcining, as the Cu is partly chloridized by this prolonged contact, and the length and cost of the calcining diminished *pro tanto*. The mixture is next spread on the hearth of a calcining furnace, be it a muffle or an open calciner. Gibbs' mechanical calciner, though of great promise, is said to have been completely abandoned. Muffles consume much more fuel than open calciners do, but they have the advantages of a more uniform temperature, of yielding much stronger acid in the condensing towers, and of offering somewhat more strongly oxidizing and chloridizing conditions than open calciners do. One of their great advantages in many other processes, their avoiding the mechanical loss of fine ore owing to the weaker draught in the calcining chamber, here counts for little, since the metals carried away by the gases, whether mechanically or from actual volatilizing, are nearly completely caught in the condensing towers.

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* Roasting of Gold and Silver Ores, by G. Kustel, 1880, p. 84.

In open calciners uniformity of temperature is promoted and overheating avoided by passing the products of the combustion of the fuel first beneath the hearth and then above it; at the same time the heat is thus well utilized. To pass the products of combustion first over the hearth and then below it causes local overheating in the parts nearest the fire. This may be considerably mitigated by a curtain arch extending forward from the top of the fire bridge a short distance, thus preventing the products of combustion while hottest from scorching the ore. This plan, however, slightly increases the consumption of fuel.

*Mode of conducting the process.**—After charging, the heat is gradually raised to a very dull red; the fire is then checked, the ore once turned, and then allowed to remain quiet for about two hours. It is now quite dark. From this time on it is worked almost uninterruptedly with paddle and rabble, the chemical reactions being thus accellerated, with consequent rise of temperature, so that, at the end of 5¼ hours, it reaches a dark red. Blue flames of S and white fumes of CO have been till now abundantly evolved, but they now rapidly decrease, till, after about 6½ hours from the beginning, they have nearly disappeared. The charge should now be of a greenish-gray color, which, with the disappearance of the blue flames, indicates that the operation is complete. Should this be verified by the chemical tests described later, the charge is immediately drawn from the furnace, preferably into pockets below it, where it remains for a long time so hot that the chemical reactions still go on. This expedient slightly shortens the time required for calcination, by enabling us to draw the charge at a somewhat earlier stage of operations.

The details of the calcining vary considerably. Sometimes only part of the salt is charged with the ore, the remainder after several hours calcining. The length of the operation varies from five hours in Gibbs' mechanical calciner to twelve hours in the Tharsis muffles, and in the gas-furnaces at Oker. The capacity of the furnaces varies from 28 to 50 square feet of hearth surface per 2,000 pounds of ore calcined in twenty-four hours. I have known as large outputs as 1 ton per 16 square feet per twenty-four hours, but the work was not thorough.

## CHEMISTRY OF THE CHLORIDIZING CALCINATION.

†§ 21. Wedding and Ulrich's analyses showed that about half the Cu in the cinders before calcining was insoluble in dilute HCl (sulphide?), one-fifth was soluble in weak HCl but not in water (oxide?), and one-third was soluble in water (sulphate?); but these proportions vary considerably. Nearly all the Fe exists as $Fe_2O_3$, though a little is present as sulphide and sulphate.

The aim of the calcination is to thoroughly convert the Cu and Ag into $CuCl_2$ and AgCl, decomposing nearly all the simultaneously formed ron chlorides into $Fe_2O_3$. With the Cu existing as $CuSO_4$ this is a simple though rather slow matter, since the salt reacts directly on it, forming $Na_2SO_4$ and $CuCl_2$. With the oxides and sulphides of Cu the case is very different, as the strongly positive sodium will hardly relinquish its Cl to so comparatively negative a metal as Cu without the intervention of some substance capable of satisfying its affinities. The oxidizing action of the air, intensified by the presence of a great excess of $Fe_2O_3$, supplies such a substance by converting the small quantity of S present into $SO_3$, which decomposes the salt, forming $Na_2SO_4$ and liberating its Cl. This unites with the Cu and in part with the Fe, and partly escapes as Cl and HCl, the formation of the latter being due to the presence of aqueous vapor.

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* See Wedding in Lunge's Sulphuric Acid and Alkali, I, p. 603.

† *Loc. cit.*, p. 589.

$$2NaCl + SO_3 + O = Na_2SO_4 + 2Cl.$$

$$2NaCl + SO_3 + H_2O = Na_2SO_4 + 2HCl.$$

$$4Cl + Cu_2S + 3O = 2CuCl_2 + SO_3.$$

And

$$2HCl + CuO = H_2O + CuCl_2.$$

If there is not enough S present to liberate sufficient Cl for the Cu and Ag, raw pyrites or some other source of S must be added. The formation of HCl is purposely aided at Oker by adding carnallite ($KClMgCl_2$), $6H_2O$, which tends to form HCl directly, thus:

$$MgCl_2 + H_2O = MgO + 2HCl.$$

If the evolution of Cl is not sufficient to chloridize all the Cu present (as is often the case with ores rich in Cu), $Cu_2Cl_2$ will be formed.

Though S is necessary, economy[*] does not permit us to have more than 1.5 parts of it to each part of Cu, or about thrice as much as is required to form $CuSO_4$, since a larger proportion would greatly prolong the calcination, thus increasing the outlay of labor and fuel, and expelling Cu from the $CuCl_2$, with formation and volatilizing of $Cu_2Cl_2$. all most undesirable.

[†]So necessary is a great excess of $Fe_2O_3$ that this process probably cannot be successfully applied to pyrites containing even as much as 20 per cent. of gangue (unless the percentage of Cu be very low indeed) without the addition of $Fe_2O_3$. The retention of the S as $SO_3$ is probably considerably favored by the use of muffles, since the contact of the flames with the ore in open calciners is liable to exert a reducing action which would favor the expulsion of S as $SO_2$, rather than its more complete oxidation and retention as sulphate. This same reducing tendency would favor the expulsion of Cl, and through it the formation of $Cu_2Cl_2$ rather than of $CuCl_2$. The Cl and HCl evolved have also a more powerful chloridizing influence on the ore over which they pass in their path through the furnace towards the condensing towers in muffles than

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[*] That it is entirely possible to completely chloridize the Cu, even in presence of much greater quantities of S. by sufficient expenditure of fuel, labor, and salt, is demonstrated by MacFarlane's experiments. (Canadian Naturalist, 2d series, II, p. 221.) With 40 per cent. salt (reckoned on the raw ore) and 100 per cent. of residues from previous operations he rendered 94.2 per cent. of the Cu contained in a mixture of *raw* pyrites and chalcopyrite containing 10 per cent. Cu soluble in water, while with 100 per cent. salt and 400 per cent. of residues he rendered 98 per cent. of the Cu contained in a similar mixture, with 23.6 per cent. Cu, soluble in water.

[†] MacFarlane (*loc. cit.*. 1st ser., VII, p. 195) showed this by calcining raw pyrites with various proportions of salt and of $Fe_2O_3$. With 400 per cent. of $Fe_2O_3$ and 100 per cent. of salt he retained as $Na_2SO_4$ 45 per cent. of the S present in the pyrites; while with 100 per cent. of salt, without $Fe_2O_3$, only 7.46 per cent. of the S was thus retained, the remainder escaping as $SO_2$. The attempt to treat by this process the pyrites of Capelton, Canada, containing about 4 per cent. Cu and 15 per cent. gangue, though intrusted to skillful metallurgists of prolonged experience in this process itself and of great intelligence, was not successful, at least financially. These ores are now profitably smelted.

in open calciners, since in the latter these gases are diluted by enormous volumes of the products of the combustion of the fuel employed for heating the furnace.

The oxidation of the sulphides is greatly favored by the presence of salt, and is much more rapid and complete in these chloridizing calcinations than in simple oxidizing ones. We may suppose that the presence of the sodium, whose oxide has such a tremendous affinity for $SO_3$, increases the tendency to form this compound by the oxidation of the sulphides, and, further, that Cu has a stronger affinity for Cl than for O at this comparatively low temperature.

Overheating and unduly prolonging the calcination tend to expel Cl from the $CuCl_2$, forming $Cu_2Cl_2$, a most undesirable compound, as explained in D and F, § § 23–25. Therefore it is important that the ore be drawn as soon as the chlorination is complete, and that the operation proceed uniformly, so that already fully chloridized portions may not be detained to await the chloridizing of more backward portions. The thickness of the body of ore on the hearth makes diligent stirring indispensable to uniformity, though it favors chloridizing by compelling the Cl evolved from the lower strata of ore as it ascends to pass for a longer time and distance in contact with the Cu compounds to be chloridized before it escapes from the upper surface of the ore.

The very small amounts of Ag and Au contained in the pyrites actually treated by this process are mostly chloridized (be it during the calcining or by the action of the brine and copper chlorides in leaching), even the unstable chloride of Au and Na formed remaining undecomposed at the low temperature and in the presence of the excess of salt employed.

The following analyses by Wedding illustrate the progress of the chemical reactions in calcining:

| Percentage of the total Cu— | After one hour. | After three hours. | After six and a half hours. |
|---|---|---|---|
| Soluble in water | 54 | 51 | 75 |
| Soluble in dilute HCl, but insoluble in water | 38 | 42 | 20 |
| Soluble only in $HNO_3$ | 8 | 7 | 5 |

Here we see that from the first to the third hour the chloridizing of the Cu has not kept pace with the decomposition of the soluble salts, since less Cu is soluble in water after three hours than after one. During the last three and a half hours, however, the Cu is rapidly chloridized, probably to a slight extent at the expense of the iron chlorides, which decompose almost completely with the now gradually rising temperature, their decomposition taking place at a considerably lower temperature than that of the chloride of copper.

*Condensing the gases.*—Since the Cu cannot be thoroughly chloridized without forming some CuO and $Cu_2Cl_2$ and volatilizing some of the latter compound, it is most important to condense the escaping gases in a Gossage tower, both to recover the volatilized copper chlorides and to obtain the strongly acid condensing liquor for leaching out the CuO and the $Cu_2Cl_2$ not volatilized, which are both insoluble in water. The gases contain, besides N and O (and $CO_2$ and CO from the products of combustion in case of open reverberatories), also $SO_2$, $SO_3$, Cl, and HCl. They are passed up through a tower loosely packed with coke (or fire-brick in the case of open calciners), through which a stream of water is trickling down. This condenses the $Cu_2Cl_2$ and any other metallic chlorides volatilized, HCl, $SO_3$, and Cl, the latter reacting on the $SO_2$ to form HCl and $H_2SO_4$, thus:

$$2Cl + 2H_2O + SO_2 = 2HCl + H_2SO_4.$$

Compounds of As and Sb which are volatilized are also caught in the condenser or "tower" liquor.

The gases from open calciners, being diluted by the products of combustion of the fuel, yield a much more dilute acid than is obtained with muffles, and, moreover, require much larger towers. Lunge* considers that the comparative weakness of the acid from open calciners matters but little. Other metallurgists have found it a serious trouble.

*Tests.*—The progress of the calcination is controlled by determining colorimetrically the amount of sulphide of copper undecomposed. The furnaceman rapidly leaches all the soluble Cu from a carefully selected sample, unweighed but of fixed volume, with water and dilute HCl. From the residue he dissolves all the Cu existing as undecomposed sulphide by a brief boiling with aqua regia, saturating the solution thus obtained with ammonia, and accurately judging from the depth of the blue color whether the chloridizing has proceeded as far as is desired.

### [C] LEACHING THE Cu, Ag, AND Au.

§ 22. In the calcined ore we have the greater part of the Cu as $CuCl_2$, some CuO, a very little $Cu_2Cl_2$ if operations have been properly conducted, and 0.1 per cent. or more Cu as insoluble sulphide. Nearly all the Ag and most of the Au exist as chlorides, almost the whole of the Fe as insoluble $Fe_2O_3$, and a little of it as chloride, sulphide, and ferric sulphate. Of these the $CuCl_2$ and part of the iron chlorides are soluble in water; the Ag and Au chlorides and a little of the CuO and $Cu_2Cl_2$ are soluble in the brine and in the metallic chlorides dissolved; the remainder of the $Cu_2Cl_2$ and CuO are soluble in the dilute acid tower liquors. Phillips adds raw salt to the calcined ore to aid in dissolving the Ag and Au chlorides, which are soluble in hot brine.

If much As or Sb were present they would interfere with dissolving the Ag, forming with it insoluble arseniates and antimoniates, as explained in §§ 5 and 13.

The still hot ore is leached in false-bottomed, tight, wooden tanks, first with weak liquors from a previous operation, then with hot water till practically all the $CuCl_2$ is removed, and finally with tower liquors, and even with additional dilute HCl or $H_2SO_4$ if necessary, the leaching liquor being in each case preferably kept boiling with steam. Such of the washings as are sufficiently rich in Cu are removed to the settling or precipitating tanks, while those which are too weak are used for leaching again. In Britain some nine washings are ordinarily used, each liquor remaining some three to four hours on the ore, so that the whole operation of leaching, charging, and discharging a tank occupies about two days.

Since the tower liquors contain As and Sb volatilized during the calcination, and since they also dissolve these elements from the ore more than the previous neutral liquors do, the washings obtained with them (containing the Cu present in the ore as $Cu_2Cl_2$ and CuO) are kept separate, yielding a comparatively impure copper. As little Cu as possible should be converted into CuO and $Cu_2Cl_2$, (1) because these compounds are with difficulty leached out of the residues, and (2) because we must concentrate the As and Sb in as small a quantity of Cu as possible, obtaining thus a larger proportion of pure copper. At Oker the amount of Cu left to be dissolved by the acid liquors is diminished by leaching the ore with "final" liquor [II] from which the Cu has been precipitated in [F], over and over, thus greatly increasing the proportion of NaCl, $FeCl_2$, and other chlorides in the leaching liquor. These chlorides vigorously attack and dissolve the chlorides of Ag and Au, the $Cu_2Cl_2$, and the CuO, and we thus avoid contaminating the Cu existing in these forms with As and Sb. Since the solutions thus obtained may contain much $Cu_2Cl_2$ (not only that existing as such in the ore, but also that due to the action of the $FeCl_2$ of the final liquor on the CuO, which yields equal parts of $Cu_2Cl_2$ and $CuCl_2$—$2FeCl_2 + 3CuO = Fe_2O_3 + CuCl_2 + Cu_2Cl_2$), which fatally interferes with the subsequent precipitation of the Ag by Claudet's method, it would probably be necessary, if his process were to be employed, to first dissolve out the bulk of the Ag with weak liquors nearly free from $Cu_2Cl_2$ and $FeCl_2$, and afterwards to attack the CuO and $Cu_2Cl_2$ with final liquor.

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* *Loc. cit.*, p. 607.

*Zn, Pb, Ca, and Mg.*—In burning pyrites the greater part and perhaps the whole of these elements, if present in moderate quantity, will be converted into sulphates, and, thus satisfied with acid, they should have no effect in precipitating Cu from its solutions. They will, however, somewhat increase the consumption of salt in calcining, since the Zn and part of the Pb and Ca will become chloridized. $ZnCl_2$ and $PbCl_2$ also increase the volatilizing of Cu and Ag, dragging these metals off as chlorides. If the process were applied to naturally oxidized ores containing oxides or carbonates of these four metals, these substances, as far as they are (A) sulphatized and (B) chloridized in the calcination, would require increased quantities of (A) sulphur and (B) salt; and whatever portions escaped sulphatizing and chloridizing would in leaching precipitate Cu as oxychloride in the residue from the $CuCl_2$, which would of course be lost, unless an amount of free acid or of other solvent were added corresponding to the total amount of ZnO, PbO, MgO, and CaO existing unsatisfied with acid at the end of the calcination. In short, before we can dissolve our Cu as chloride we must supply with acid the more powerful bases CaO, MgO, PbO, and ZnO present by increased quantities of sulphur and salt, aided perhaps by additions of free acid, chloride of iron,* or other solvent. If these bases were present in large amount, this might be a very serious if not a fatal matter. A similar course would have to be followed in the case of pyrites containing an excessive amount of oxides or carbonates of these four metals. The presence of any considerable amount of Pb might also cause a very heavy loss of iodine in precipitating the Ag.

We have now (1) a residue [4], practically a rich iron ore, which may be used for fettling puddling furnaces, for 20 to 30 per cent. of the charge in iron blast-furnaces, for the pig-and-ore open-hearth process, or for a direct process (by which, indeed, a portion of it may be utilized as iron sponge for precipitating the Cu from the solutions), and (2) washings [5], of which the first three contain 95 per cent. of the Ag dissolved, and are treated for that metal, the others being directly treated for Cu as in [F].

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* The oxychloride of copper which is precipitated from these solutions by CaO, &c., is, according to Hunt, readily dissolved by $FeCl_2$.

### [D] PRECIPITATING THE Ag AND Au BY CLAUDET'S PROCESS.

§ 23. The first three washings* after being clarified by standing several hours in an intermediate set of tanks, during which time their tenor in Ag is accurately determined, are run to the Ag preciptating tanks, and simultaneously diluted with about 10 per cent. of water, containing an excess of $ZnI_2$ and I above that needed to precipitate the Ag as AgI. This salt, almost completely insoluble in the liquor, slowly settles out, together with $PbI_2$ and $PbSO_4$. After settling for two days, during which it is tested to see whether all the Ag has been converted into AgI, the liquor is run off to the Cu precipitating tanks [F]. The Au precipitates with the Ag.

The presence of $Cu_2Cl_2$ is fatal to this process: first, because it prevents the complete precipitation of the Ag, and, second, because on diluting and adding iodide it precipitates, seriously contaminating the precipitated silver.† The difficulty of avoiding the formation of $Cu_2Cl_2$ has prevented the very extended use of this process, though it has been eminently successful in careful and intelligent hands. T. Sterry Hunt's researches, however, render it probable that the $Cu_2Cl_2$ can be mostly, if not wholly, converted into $CuCl_2$ by adding a small amount of dilute HCl and blowing air through the liquor, or a small amount of Cl gas might be blown into the liquor.

$$Cu_2Cl_2 + 2HCl + O = 2CuCl_2 + H_2O.$$

Although several metallurgists have unsuccessfully endeavored to perchloridize the $Cu_2Cl_2$ in this way, Hunt's results were so complete and so readily effected that it is hard to believe that the difficulties are really insuperable. If this should turn out to be practicable, it would remove the only serious obstacle to the extensive adoption of Claudet's process.

### [E] REDUCING THE Ag AND REGENERATING THE $ZnI_2$.

§ 24. When a sufficient amount of the precipitated iodides have collected, they are washed and treated with metallic zinc and a little HCl, when we obtain metallic Ag, Au, and Pb, all the AgI and $PbI_2$ and part of the $PbSO_4$ being reduced. A solution of $ZnI_2$ is obtained, which is used for precipitating a fresh portion of Ag and Au. The slight waste of iodine which inevitably takes place is met by adding KI. The reduced Ag, Au, and Pb sponge is sent to silver refineries.

The cost of the whole operation of recovering the Ag and Au by Claudet's method at Widnes is, according to Phillips, only 8*d.*, or, say, 16 cents, per ton of ore treated.

### OTHER MEANS OF SEPARATING THE MIXED CHLORIDES.

§ 24*a*. *Mayer* proposes to mechanically perfect the precipitation of the AgI by adding glue with the precipitant, and a little later a solution of tannin. This would collect the finely divided AgI and drag it down. He then treats the precipitated iodides with alkaline sulphides, obtaining alkaline iodides, to be used for precipitating fresh portions of Ag, and sulphides of Ag, Au, and Pb.

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* In some works, owing to the leakage from the tanks and the difficulties in keeping the several washings separate, it has been found more convenient to treat all the washings for silver. If the ore contained much Pb, this metal might, as already suggested, precipitate as $PbI_2$ to such an extent as to fatally increase the loss of iodine, which is not *completely* regenerated in [E].

†Gibb, Chem. News, 1875, p. 165.

*Gibb's* process precipitates a small portion of the Cu as CuS with $H_2S$, the greater part of the Ag falling as $Ag_2S$ with the first portions of the Cu. The mixed sulphides are calcined, so as to convert part of the Cu into $CuSO_4$, the rest into oxide and oxychloride, the Ag being converted into chloride. After leaching out the $CuSO_4$ the residue is leached with hot brine, which dissolves the Ag and some Cu. They are precipitated together with milk of lime, and the Cu dissolved with weak $H_2SO_4$. At Oker sulphide of sodium has been used for this fractional precipitation, instead of $H_2S$.

*Snelus* blows into the mixed chloride solution enough pulverized iron sponge to precipitate about 19 per cent of the Cu, with which about 80 per cent of the Ag is said to be precipitated.

*Jardine and Chadwick* dilute the mixed chloride solution and add a very dilute solution of acetate of lead, when the Ag, mixed with $PbSO_4$, precipitates. Some metallurgists regard the action of the acetate of lead as largely mechanical, the $PbSO_4$ formed merely dragging down the Ag, which is precipitated in a very finely divided state on diluting the chloride liquor.

*Phillips* applies the Augustin process to the mixed precipitate of cement, Ag and Cu, by calcining it, after an admixture of salt and soda, so as to form AgCl, which he leaches out with brine.

## [F] PRECIPITATING THE Cu.

§ 25. The cupreous solution, including the now desilverized first three washings, is boiled with steam in tanks containing scrap iron or iron sponge, which precipitates the Cu rapidly and nearly completely. It only requires half as much Fe to precipitate a unit of Cu from $Cu_2Cl_2$ as from $CuCl_2$,* but on account of the difficulty of wholly leaching the former salt from the residues, and of completely precipitating its Cu on iron; on account of the impurity of the precipitate produced from it if it is removed with tower liquors, and its interfering with the precipitation of the Ag as already explained, its formation in calcining is avoided as far as possible.

The method employed at Oker, however, of forming $Cu_2Cl_2$ by the action of the $FeCl_2$ of the "final" liquors on CuO still economizes Fe, while it escapes contamination from the tower liquors and avoids interference with the precipitation of Ag if, as I have suggested, the Ag be removed with the $CuCl_2$ by water before attacking the CuO with final liquor. The difficulties of completely removing the $Cu_2Cl_2$ from the residues, and of thoroughly precipitating its Cu, would of course remain.

It is desirable to keep the precipitating tanks closely covered, to prevent the air from converting the $FeCl_2$ present into ferric salts, which consume iron to no purpose and precipitate as basic chlorides, contaminating the Cu, from which they can only be removed at great expense. For the same reason the Fe should be as completely as possible converted into insoluble $Fe_2O_3$ in the calcining. If ferric chlorides are present in considerable quantity they can be reduced to

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* $Fe + CuCl_2 = Cu + FeCl_2$, and $Fe + Cu_2Cl_2 = 2Cu + FeCl_2$.

$FeCl_2$ by passing $SO_2$ through the liquor, just as ferric sulphates are reduced at Agordo.*

It is but a step further to precipitate the Cu as $Cu_2Cl_2$ by forcing strong $SO_2$ through the liquor, as in the Hunt and Douglas process (§ 43). From the precipitated $Cu_2Cl_2$ the Cu can be very cheaply recovered, according to Hunt, as explained in § 44, at a very much smaller cost than by precipitating on iron, as is now universally done.

If at Oker, before leaching the ore with their final liquor, they had carried out and slightly extended the Agordo practice of treating the liquor with $SO_2$, they would have had the essence of the Hunt and Douglas process.

### [G] WASHING AND REFINING THE CEMENT COPPER.

§ 26. The cement copper is thoroughly washed to remove the last traces of Cl, which would volatilize Cu in the subsequent refining, and, if it is to be sent to a distance, is dried and bagged. It is then smelted in reverberatories, its fineness and lightness necessitating great care while charging it to prevent its being carried away by the draught. To avoid this it is sometimes charged wet, sometimes dry and still inclosed in the bags in which it has been transported. Unless it is thoroughly wet, the draught should be wholly shut off from the furnace while charging it.

The cement obtained from leaching with water should be brought at once to the condition of blister copper, to which end it may be smelted with rich white or pimple metal (very rich sulphides of Cu almost free from Fe), whose S will unite with the O of any oxidized Cu in the cement, the Cu in each passing to the metallic state.

$$2CuO + Cu_2S = SO_2 + 4Cu.$$

The cement obtained from the tower liquors will, except in the case of very pure ores, contain much As, and it should therefore be smelted with some furnace product containing considerable S, yielding a comparatively crude product, so that the As may be removed in the long series of operations it has to undergo before reaching the condition of blister copper. The blister copper is refined in the ordinary way.

A cupola smelting is undesirable for cement, since it would tend to reduce the iron oxides it contains, which would alloy with the Cu, only to be afterwards separated with difficulty. Moreover, there would be danger of the fine cement's being blown away from the mouth of the cupola by the blast, causing serious inconvenience, if not heavy loss.

### ECONOMIC FEATURES.

§ 27. The preliminary burning of the ore is inexpensive and easy; fine crushing is not required for the calcination, which, moreover, does not require a great expenditure of labor or fuel. The expense of handling the ore is rather heavy, 4 or 5 handlings of the whole mass being required; once into the kilns, once thence to the crushing apparatus, once thence to the calciner (this may be done by machinery), once thence to the leaching tanks, and once thence to the iron works or the waste dumps.

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*Ann. Mines, 1876. $Fe_2Cl_6 + SO_2 + 2H_2O = 2FeCl_2 + 2HCl + H_2SO_4$. In leaching the copper sulphates from arsenical ores at Agordo the use of $SO_2$ incidentally enabled them to eliminate most of the As and to concentrate the remainder in a small part of the Cu, thus obtaining most of the Cu in a comparatively pure state. The $SO_2$ reduces the $As_2O_5$ to $As_2O_3$, which falls as a light, fine powder, easily washed out of the large flakes of copper which adhere to the scrap iron. The fine-grained portion, which at Agordo contained 30 per cent. of the Cu, carried 4.93 per cent As. The larger flakes, containing 70 per cent. of the Cu, had only 0.6 per cent. of As, about 80 per cent. of this element having been removed by washing. But for the use of $SO_2$ practically all the As would have precipitated as subarseniate of iron, which could not have been removed from the cement by washing. It is possible that the As might be similarly eliminated from the chloride solutions of the Longmaid process.

The extraction of the Cu is perhaps uniquely complete, 95 to 98 per cent. of it being recovered, leaving sometimes only 0.13 per cent. in the residues. Seventy-five per cent. of the Ag and about as much of the Au are recovered from ores containing only from 0.75 to 1.2 ounces of Ag and, say, 0.0001 per cent. Au. The cost of recovering the precious metals from such ores is only, say, 16 cents per ton of ore.

Intelligence, skill, and care are needed, especially in calcining, but not to such an extreme degree as in the Ziervogel and Augustin processes.

The plant required, including the pyrites burners and the silver precipitating tanks, is pretty expensive. While it might be more readily and cheaply combined with a sulphuric acid plant (which would itself need the pyrites burners) than a plant for either the Ziervogel, Augustin, or sulphuric acid process could, if we include the furnaces for the preliminary calcinings and smeltings which these processes require; yet the plant for either of these latter processes would be more readily and cheaply combined with a general smelting and refining establishment (which would itself need furnaces suited for preparing the ore for these methods) than would the Longmaid plant, at least in case of ores which yield on smelting but a small weight of matte. The Hunt and Douglas plant will probably be less costly than the Longmaid.

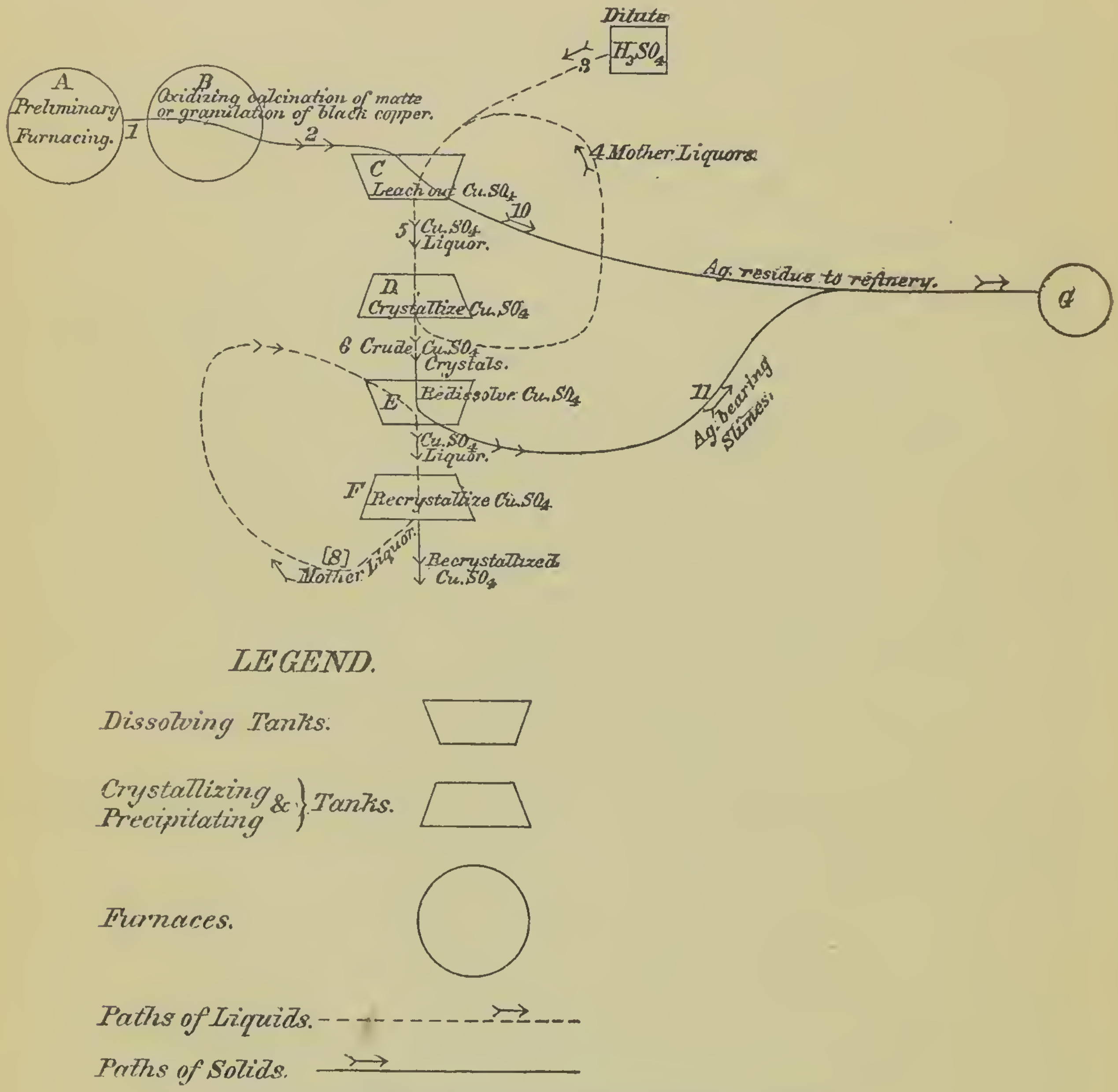
The consumption of salt is enormous, 15 and even 20 per cent. being required, and the consumption of iron, rarely less than 1 pound per pound of copper recovered, runs in unskillful hands up to 1.2 pounds and even more. The pollution of the rivers by the final liquors has been in Britain a very serious inconvenience. With arsenical ores part if not all of the Cu is contaminated with this noxious element.

## APPLICABILITY OF THE COMBINED PROCESSES.

The enormous amount of $Fe_2O_3$ required to chloridize each unit of Cu chemically restricts the combined processes to ores containing little Cu and consisting almost wholly of sulphide (or oxide) of iron. As the consumption of iron for precipitating, generally the heaviest item of expense, is directly proportional to the amount of copper recovered, while the expense of smelting processes is nearly the same per ton of ore for rich as for lean ores, the process is economically limited to low-grade ores.

Further experience is required to indicate whether it can be applied to ores rich in Ag without too great consumption of iodine. From what has been said we can see that the combined processes here considered are especially applicable to ores with but little Ag and Cu, little or no Ca, Mg, Zn, Pb, As, and Sb, but very rich in Fe; where salt and scrap iron are very cheap; where smelting fuel is costly; where the copious waste liquors can be harmlessly disposed of, and where there is a market for the iron-oxide residue and for the sulphuric acid produced in burning the ore.

The material pre-eminently fitted for this process is the cinders resulting from burning pyrites for sulphuric acid making, especially if they be lean in copper and quite free from gangue. But if they contain as much as 4, or perhaps even 3, per cent. of copper, or any considerable amount of gangue, they will under the conditions existing and likely to continue on our eastern coast be more advantageously treated by smelting, and, if argentiferous, by treating the resulting matte or black copper by electrolysis, by the sulphuric acid process, or perhaps by the Hunt and Douglas process. Indeed, the latter might be directly applied to these cinders without smelting.



Tree of the sulphuric acid process applied to mattes.

## SEPARATION OF COPPER FROM SILVER BY DILUTE SULPHURIC ACID,* OR VITRIOLIZATION—BASIS OF THE PROCESS.

§ 28. The copper of rich matte, or of black copper, is dissolved as sulphate by weak sulphuric acid, silver, gold, arsenic, and antimony remaining in the residue, which in the case of mattes also retains the iron. The process as applied to matte is based on the solubility of CuO and the insolubility of Ag, Au, $Sb_2O_5$, and $Fe_2O_3$ in dilute $H_2SO_4$ after a thorough oxidizing calcination; and, as applied to granulated black copper, on the insolubility of Ag, Au, Sb, and As, and the solubility of Cu in $H_2SO_4$ with free access of air.

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[*] Crookes & Rohrig's Adaptation of Kerl's Metallurgy, I, p. 395; Revue Universelle X, 1881, p. 248; Mineral Resources of the United States, A. Williams, jr., 1883, p. 297 Percy's Metallurgy of Silver and Gold, I, p. 494; Kerl, Grundriss der Metallhüttenkund 1881, p. 359; Traité de Chimie Technologique et Industrielle, Fr. Knapp, 1876, II, p 9, 869.

### GENERAL OUTLINE.

The process may be conveniently considered under the following heads:

*[A] Preliminary calcinations and smeltings, yielding black copper or rich white metal [1], nearly free from iron.

[B] An oxidizing calcination of the matte or a granulation of the black copper.

[C] Dissolving the CuO or Cu [2] in dilute $H_2SO_4$ [3] and clarifying the solution.

[D] Crystallizing the $CuSO_4$ [5].

[E] and [F] dissolving and recrystallizing the crude $CuSO_4$ [6].

[G] Refining the argentiferous and auriferous residue [10] and [11].

The copper-silver compound is enriched, if necessary, by a preliminary series of calcinings and smeltings, either to black copper or to a rich copper matte nearly free from iron. If matte, it then undergoes a very thorough oxidizing calcination [B], bringing the Ag and Au to the metallic state, and the Cu and Fe to the condition of oxides. Its CuO is next dissolved in [C] with dilute $H_2SO_4$ [3], mixed with mothers liquors [4] of the crude bluestone or $CuSO_4$, yielding a residue [10] containing the Ag, Au, and $Fe_2O_3$, which is treated for the precious metals, and a solution [5] of $CuSO_4$, clarified by decantation, from which the $CuSO_4$ is crystalized in [D]. The mother liquor [4] from this crystalization is used for diluting the $H_2SO_4$, with which fresh portions of Cu are dissolved.

The crystals [6] are redissolved in [E] and recrystallized in [F], yielding pure marketable sulphate of copper. The mother liquor [8] from this crystallization may be used for dissolving fresh lots of crude Cu $SO_4$, or concentrated and its $CuSO_2$ crystallized out; or its Cu may be precipitated on scrap iron or with lime or by electrolysis.

The slimes [11] set free on dissolving the crude $CuSO_4$ are added to the original residues [10]. Ni, if present, will accumulate in the mother liquor [4] of the crude $CuSO_4$, from which it may occasionally be recovered by crystallizing.

IF BLACK COPPER is treated, it is granulated and repeatedly moistened with hot dilute $H_2SO_4$, being arranged so that the air draws freely through it, the Cu rapidly oxidizing and being carried off by the acid which trickles through the granulated mass, the solution escaping through troughs, where the crude $CuSO_4$ crystallizes as it cools. The further treatment of the residues, crude crystals, and mother liquor is the same as in the case of matte. Or the solution of $CuSO_4$ may be electrolysed directly, yielding metallic copper instead of copper sulphates; or the Cu may be precipitated by scrap or spongy iron or milk of lime from the aqueous solution of tbe crude crystals; or, by clarifying the original solution by filtering or decantation, the $H_2SO_4$ may be partly recovered by retorting the crude crystals.

### DETAILED DESCRIPTION.

§ 29. Passing by the preliminary concentration of the Cu and Ag into rich white metal or black copper, whose description, though valuable, would carry us beyond the limits of this paper, let us take up first the treatment of the white metal, and next that of the black copper, carrying the consideration of each separately as far as [D] crystallizing the crude $CuSO_4$, and from that point considering simultaneously the treatment of both materials.

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* The figures and letters in brackets refer to the accompanying tree.

### [B] OXIDIZING CALCINATION OF THE WHITE METAL.

The progress of the chemical reactions in the oxidizing calcination of copper-silver matte has already been considered in §§ 4 and 5, to which the reader is referred. Here, however, the operation must be carried much further than in the Ziervogel process, since we aim at completely decomposing the $Ag_2SO_4$ produced. This we accomplish by "dead-roasting" the matte, raising the temperature above the decomposition point of $Ag_2SO_4$ and prolonging the calcining sufficiently to insure the complete decomposition of that salt. The prolonged and high heat incidentally renders the $Fe_2O_3$ nearly insoluble in the dilute $H_2SO_4$ employed as a solvent for the CuO. As and Sb are converted into antimoniates and arseniates; Ag and Au are brought to the metallic state. The oxidation of the matte must be complete, since if any $Cu_2O$ is left it will yield an equivalent of metallic Cu which is not attacked by the dilute $H_2SO_4$ unless contact with the air insures its oxidation.

$$Cu_2O+H_2SO_4=Cu+CuSO_4+H_2O.$$

### [C] LEACHING THE CALCINED MATTE.

§ 30. It is treated for about five hours in lead-lined tanks, whose bottoms should be protected by a board flooring, or more rarely in rotating barrels, with hot dilute $H_2SO_4$, diluted to about 30° B. with the mother liquors [4] from crystallizing previous solutions and with water. The mass is frequently stirred, and is kept boiling with steam. After about five hours the steam is stopped, and the residues allowed to settle. The solution is then tapped or siphoned off, and the residues washed with water, which is added to the solution.

The CuO (and ZnO and NiO if present) is readily dissolved by the hot though dilute $H_2SO_4$, the ignited $Fe_2O_3$ but little, the Ag and the arseniates and antimoniates hardly at all, and the Au not at all. If, from the presence of undecomposed $Ag_2SO_4$, or from other cause, any important quantity of Ag should be dissolved, it should be reprecipitated by digesting the still hot solution with copper slabs* or granules, or with copper scale.† The latter consists largely of $Cu_2O$, which is attacked by the free acid present, yielding $CuSO_4$ and metallic Cu (as shown in the equation last given), which is separated in a finely divided state very favorable for rapidly and thoroughly precipitating the dissolved Ag. By increasing the strength of the acid employed the amount of Cu left undissolved in the residues is diminished, but more Ag is likely to be dissolved. This, however, need do little harm if it be reprecipitated as just described.

### [D] CRYSTALLIZING THE CRUDE $CuSO_4$.

§ 31. The clarified solution, thus deprived of its Ag if necessary, stands for several (say six) days in lead-lined tanks, while the crude $CuSO_4$ crystallizes on the sides and bottom of the tanks, and on strips of lead suspended in the liquor to increase the surface offered for crystallization.

At the end of this time the mother liquors are drawn off, and as they contain much Cu and free $H_2SO_4$, they are generally used to dilute to the proper degree the $H_2SO_4$ used for dissolving a fresh lot of calcined matte.

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* Mineral Resources of the United States, 1883, p. 300.

† Percy, Metallurgy of Gold and Silver and Gold, I, p. 497

*Nickel.**—If this metal is present in the matte it will gradually accumulate in the mother liquors, since they are in general used over and over indefinitely. When the liquor is sufficiently rich in Ni it is concentrated so as to crystallize out the nickel sulphate. This is generally redissolved and recrystallized.

†Any $FeSO_4$ dissolved is liable to crystallize out with the $CuSO_4$, from which it cannot be separated by mere recrystallizing, since the two salts are apt to crystallize together isomorphously. If the $FeSO_4$ be converted into $Fe_2(SO_4)^3$ by treating the solution with $HNO_3$, by exposing it to the air, or otherwise, the $CuSO_4$ crystals will no longer be contaminated with Fe.

## TREATMENT OF BLACK COPPER.

### [B′] GRANULATION OF THE BLACK COPPER.

§ 32. The black or blister copper is in general tapped from the hearth of a reverberatory melting furnace in a thin stream into a deep and large basin of water, certain precautions being needed to prevent explosions, which may be very serious and even dangerous. The main thing appears to be to have a large enough and deep enough basin so that the grains of copper may become thoroughly solidified before they reach the bottom. If the tank is shallow the grains may reach the bottom quite liquid inside, and with only a thin shell of solidified metal on the outside. As they lie on the bottom, where their heat is no longer as rapidly abstracted as it was during their rapid descent through the water, the interior of the several granules may still be sufficiently above the melting point of copper to reliquefy the thin external shells, when we may actually get liquid copper at the bottom of the basin, with the danger of a terrible explosion. It is often thought well to have a large stream of water forced into the bottom of the granulating basin, insuring a rapid circulation there, so as to keep the copper cool after it has reached the bottom. Sometimes a jet of water impinges on the stream of still liquid copper just before it reaches the surface of the water, thus distributing it, and preventing it from falling in large masses or suddenly accumulating at any one point on the bottom. This also breaks the copper into very fine grains, which of course offer more surface to the $H_2SO_4$ in the next operation. In order to still further increase the surface exposure the copper might be tapped out of the furnace just as it reaches the point at which it has lost nearly the whole of its SS but has not yet absorbed any considerable amount of O, since at this pitch the granules formed will be hollow, according to Egleston.‡

*Nickel.*—If the copper contains Ni, it may not be desirable to carry the refining to the point just mentioned. The Ni existing in the ore is concentrated along with the Cu and Ag during the preliminary series of calcinings and smeltings till the condition of black or blister copper is reached, but in refining this product the Ni is oxidized and slagged§ (at least in some cases) before the whole of the S is removed. Since the gradual concentration in the mother liquor, as already described, of even minute traces of Ni existing in the copper is a most convenient and economical mode of extracting that metal, the refining operation should be stopped before any appreciable amount of Ni is slagged.

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*Revue Universelles, X, 1881, p. 250.

†Watts' Dictionary of Chemistry, V, 591, 1874.

‡Trans. Am. Inst. Min. Eng., IV, p. 297.

§Ibid, X, p. 49, and Crookes and Rohrigs adaptation of Kerl's Metallurgy, I, p. 566.

This may not in general prevent obtaining crystals of $CuSO_4$ free from Fe, since (according to Kerl*) the Fe is slagged before the Ni in the refining operation. In case, however, the black copper contains an excessive amount of Fe, it may be necessary to carry the refining far enough to slag part of the Ni in order to get rid of the Fe, if it be imperative that the crystals of $CuSO_4$ be quite free from $FeSO_4$. The Ni and Co will then be found concentrated in the slags, from which they may be extracted, if present in profitable quantity.

### [C′.] DISSOLVING THE GRANULATED BLACK COPPER.

§ 33. On the perforated false bottom of a lead-lined tank is placed a layer of lumps of copper, and above this a charge of the granulated copper. Over the surface of these granules is scattered at short intervals a spray of hot $H_2SO_4$, diluted to about 30° B. with the mother liquors from crystallizing crude Cu $SO_4$ and with water. A large opening in the bottom allows the air to pass up rapidly through the mass of granules, through which the intermittently added $H_2SO_4$ trickles down. With this enormous surface exposure to the air the Cu is rapidly oxidized and dissolved by the hot acid, which escapes freely from the bottom of the tank into a very long trough, sometimes several hundred feet long, in which the slime mechanically carried out by the acid liquors settles, and the $CuSO_4$ gradually crystallizes as the liquor cools, inclosing the slime.

Nearly all the Cu, and probably all the Fe, Ni, and Co, dissolve readily in the hot acid. Au is unacted on, but Ag is not absolutely insoluble even in acid of 28° B., according to Kerl,† and its solubility increases with the rise of temperature and with the strength of the acid. Its solubility is also said to be greater in acid fresh from the chambers and holding nitrogen compounds. Pb, in the spongy state in which it is left when the Cu is dissolved, is said to be largely converted into $PbSO_4$, which forms in many cases a large part of the insoluble residue. Sb remains almost wholly in the residue as basic sulphate, while As dissolves only to a very slight extent, remaining mostly in the residue as arseniate (*e. g.*, of Pb). Antimoniate of Ag and of Pb, and arseniate of Ag are decomposed slowly in the cold. but rapidly when hot, with separation of arsenic and antimonic acids.

According to Knapp, ‡ the acid in which the Cu is dissolved should, after diluting with the mother liquors and with water, mark 30° to 35° B., and should be at 70° C., since it has its highest dissolving power at this temperature and degree of concentration. If it is more concentrated, anhydrous $CuSO_4$ is liable to crystallize out, which would then be very liable to escape solution.

As in the case of matte, Ni, if present, will gradually accumulate in the solution, from which it may be recovered at intervals by evaporating and crystallizing the $NiSO_4$. Fe, even if present in but small proportion, is liable to crystallize out with the $CuSO_4$.

*Clarifying.*—If the crude $CuSO_4$ crystals are not to be recrystallized, the solution, as it runs from the dissolving tanks, must be allowed before crystallizing to stand several hours, so that any Ag and Au mechanically carried out may settle, since they would otherwise become entangled in the $CuSO_4$ crystals and be lost.

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* Kerl, Grundriss der Metallhüttenkunde, 1881, p. 217.

† Grundriss der Metallhüttenkunde, 1881, p. 362.

‡ Traité de Chimie Technologique et Industrielle, Fr. Knapp, Dunod, 1876. p. 871.

### [E] AND [F] RECRYSTALLIZING THE $CuSO_4$ FROM MATTE OR BLACK COPPER.

§ 34. Since foreign substances dissolved or suspended in the original solution will contaminate the crude $CuSO_4$ crystals we have just obtained, it is generally necessary to recrystallize them, if they are to be in the market. Indeed, even if the first crystals be actually pure, they offered will be small and difficult to sell, since, as in so many other cases, purchasers are guided largely by the outward appearance of the crystals.

In order to obtain large, handsome crystals * it is necessary that the solution should not be too concentrated, that it should be as neutral as possible, and that it should cool very slowly, which necessitates the use of large and tightly-closed crystallizing tanks. In order to obtain a strictly neutral solution, the crude crystals should be washed with water to remove the portions of the first acid mother liquor adhering to them. They are then dissolved in the mother liquors [8] from recrystallizing a previous portion of $CuSO_4$. Since even after washing the crystals they will yield a certain amount of acid and other impurities which will accumulate in the mother liquors [8] of the second crystallization, it is advisable, if the production of large crystals is imperative, not to use the mother liquors more than a few times, but to employ them to dilute the $H_2SO_4$ [3] when by repeated use they have grown too impure for the second crystallization.

In dissolving the crude crystals the mother liquors [8] are diluted with a proper amount of water, heated to boiling, and the previously washed crude crystals are gradually introduced and dissolved, with constant stirring, until the proper degree of concentration has been reached * (28 to 29 B., according to Knapp). The solution is clarified by decantation, and allowed to cool gradually in large closed tanks, where the refined $CuSO_4$ gradually crystallizes out. Lead strips are usually suspended in the solution, to increase the surface offered for crystallizing.

Of course, water may be used instead of the mother liquors [8] for dissolving the crude crystals, the residual Cu in the mother liquors from their recrystallizing being then recovered by precipitating by iron, lime, or electrolysis, or by evaporating and crystallizing.

When the crystallizing is complete the mother liquors are withdrawn, the crystals are allowed to drain on inclined boards, washed by swinging them through pure water in open baskets, dried in appropriate chambers, and are then ready for market.

### [G] REFINING THE RESIDUES.

§ 35. The residues often, or perhaps generally, contain so much Cu that it is desirable to smelt them with Pb and enough S to remove the Cu as a matte. In case the material treated contains much Pb, this may be present to such an extent in the residues as sulphate as to furnish sufficient S to remove the Cu.

The resulting argentiferous and auriferous lead would be ordinarily sent to a silver refinery for cupellation, parting, &c. The residues are occasionally, though less frequently, treated in the wet way.

### ECONOMIC FEATURES.

§ 36. Owing to its great consumption of sulphuric acid and to the general necessity of calcining and smelting the ore, and of perhaps repeatedly

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* Knapp, Traité de Chimie Eechnologique et Industrielle, Dunod, 1876, p. 872.

calcining and smelting the crude matte thus produced before applying this process, while the Longmaid, Hunt and Douglas, Patera, and Doetsch processes are directly applied to the ore, the sulphuric acid process is in general more especially applicable in refining centers than at the mines. Its ease, simplicity, and broad range of applicability make it especially desirable for treating the large quantities of often impure matte and black copper which reach our eastern coast, where the supply of sulphuric acid is abundant and cheap, and where, indeed, certain forms of sulphuric acid unfitted for other purposes may be obtained for dissolving the copper at a very low price. Its use in these places is only likely to be limited by the difficulty of disposing of any great increase of the production of bluestone, and by the competition of electrolytic methods in refining establishments which have the good fortune to have cheap and abundant water-power. In being directly applicable to mattes as well as black copper the sulphuric acid process has a distinct advantage over the electrolytic methods so far devised, none of which are applicable to mattes.

Though most ores contain such a large percentage of substances (such as CaO, MgO, Fe, Zn, Pb, &c.), which would consume $H_2SO_4$ fruitlessly, that this process cannot be economically applied to them, it might be advantageously applied to highly silicious ores and others which had but a small percentage of substances other than copper which are attacked by the $H_2SO_4$, always provided that that acid is cheap and abundant.

Where copper ores occur with pyrites or brimstone near silver mining districts, as at Dayton, Nev., and Nantoco, in Chili, the local demand for bluestone often makes this process particularly remunerative. Although it is a little more expensive as applied to mattes than as applied to black copper, since the former require an expensive dead roasting before applying the acid, which is applied to the latter directly, this is generally more than outweighed by the cost of bringing the matte forward to the condition of black copper. However, with mattes made at a distance from the works where the sulphuric acid process is to be employed, the extra cost of the dead roasting combined with the heavier freight charges per unit of copper due to shipping a 75 per cent. matte instead of a 96 per cent. black copper may compensate for the expense of bringing the matte forward to black copper before shipping it. The furnace treatment required to bring the matte forward to black copper before treating with acid inevitably increases the loss of both Ag and Cu.

The following table gives the consumption of materials in treating black copper and producing refined bluestone by this process in careful hands:

*Consumption of materials in treating black copper at Altenau in* 1876.

[119,611 kilograms of black copper, containing 91 to 97 per cent. Cu and, say, 60 to 120 ounces Ag per ton.]

| | | | Tons. |
|---|---|---|---|
| Sulphuric acid, per ton of copper treated | | | 2.64 |
| Coal for boilers, per ton of copper treated | tons | 1.85 | |
| Coal for heating sulphuric acid | do | 0.89 | |
| Coal for drying the $CuSO_4$ crystals | do | 0.12 | |
| | | | 2.86 |
| Sulphate of copper produced per ton treated | | | 2.63 |

The plant required is probably more costly than that of the Ziervogel and Augustin processes, especially if the production of large, handsome crystals is aimed at. If we include the furnaces needed for the preliminary calcinings and smeltings, it probably costs more than the plants required for the Longmaid and the Hunt and Douglas processes; yet it would probably be less costly to adapt a general refining establishment to the use of the sulphuric-acid process than to that of the two latter methods, especially for ores yielding but little matte, since such an establishment would ordinarily require the furnaces needed for the preliminary operations of smelting and calcining for this process. The cost of the plant per ton of ore treated would of course increase rapidly with the proportion of matte yielded by the ore, while this would affect the cost of the Hunt and Douglas and Longmaid plants but little.

### ADVANTAGES AND DISADVANTAGES OF THE PROCESS.

§ 37. To sum up, the chief advantages of the process are—

(1.) Its extreme simplicity and ease of application.

(2.) Its yielding a pure copper even from arsenical and antimonial materials.

(3.) The very broad range of copper-silver compounds to which it is easily applicable.

(4.) Its convenient and cheap recovery of even minute traces of Ni, which are gradually accumulated in the liquor.

(5.) The very complete recovery both of Cu and of the precious metals contained in the matte or black copper treated; though, of course, there may be a heavy loss in the preliminary calcinings and smeltings by which these crude products are obtained.

Its chief disadvantages are—

(1.) The enormous quantities of sulphuric acid needed.

(2.) The generally very costly series of calcinings and smeltings needed to obtain a product rich enough to be economically treated.

(3.) That the product is bluestone, to advantageously dispose of large quantities of which may hereafter be no easy matter.

### APPLICABILITY.

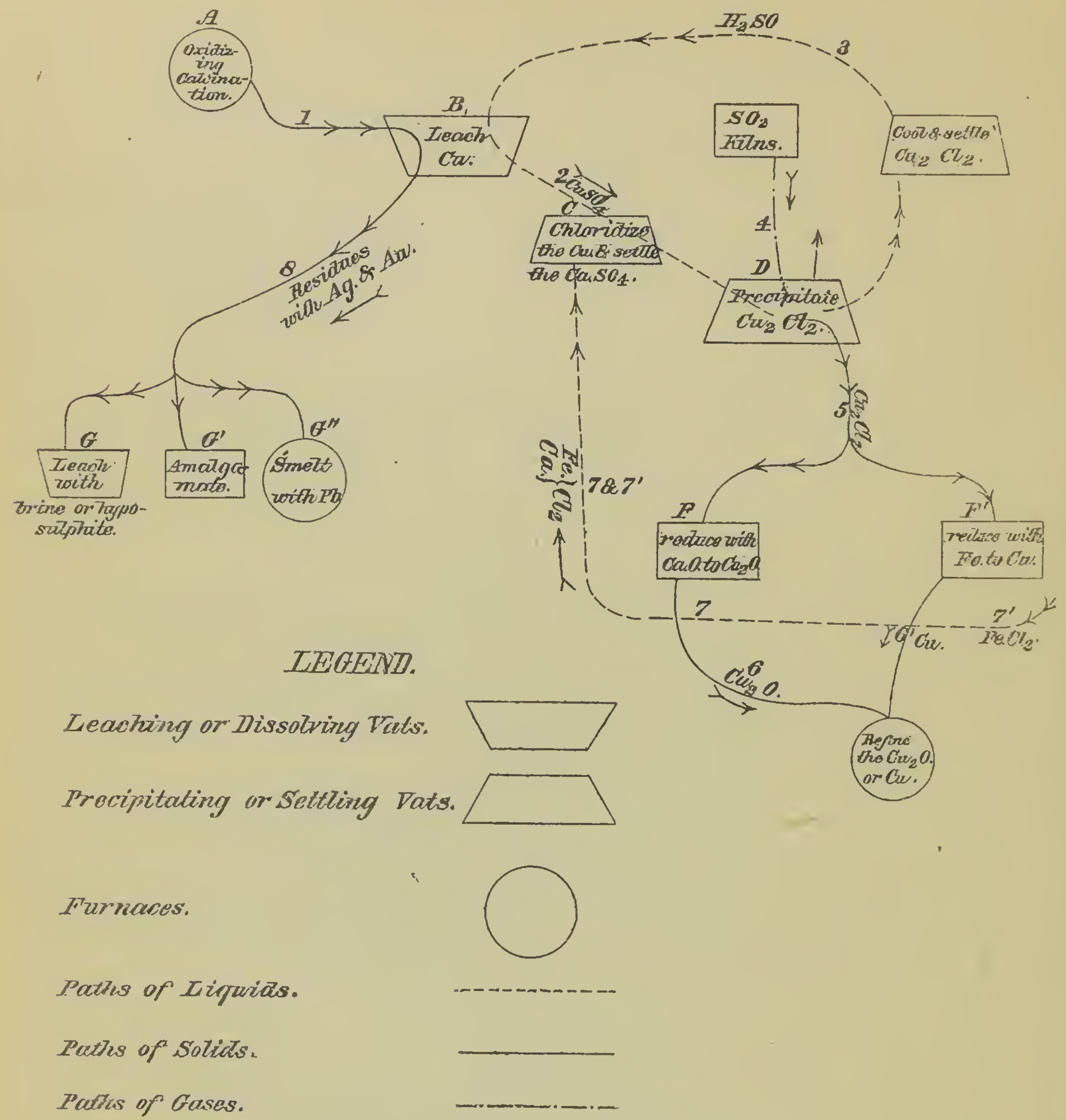
§ 38. From what has been said we can see that the process is chiefly applicable—

(1.) To argentiferous copper mattes and black copper in large refining centers where sulphuric acid is cheap and abundant; where complete reliance on extremely skilled employés is not desired; where there is a ready market for bluestone; where the lack of cheap water-power prevents the use of electrolysis; and especially where there is a large supply of varying grades of impure black copper and furnace products (particularly if some of them carry nickel), the presence of As, Sb, and Pb interfering with the use of the Ziervogel and Augustin processes.

(2.) Where argentiferous copper ores occur in the neighborhood of extensive silver mines and of deposits of pyrites or brimstone, the local demands for bluestone for the silver extraction insuring a market for this generally troublesome product.

(3.) It cannot be directly applied to ores which have any considerable amount of CaO, MgO, Fe, Zn, Pb, or other substance which is acted on by sulphuric acid; but if acid were very cheap it might be applied to rich ores free from such substances.

(4.) It is also advantageously used for dissolving the Cu from highly cupriferous alloys of Ag and Au before parting.



Tree illustrating the Hunt and Douglas process.

## THE HUNT AND DOUGLAS PROCESS.*

§ 39. This very promising, ingenious, and beautiful process, the joint invention of James Douglas, jr., and the illustrious T. Sterry Hunt, is based upon the rapid and cheap production of sulphuric acid, by passing $SO_2$ gas through a solution of $Cu\,Cl_2$, this salt being simultaneously reduced with precipitation of $Cu_2Cl_2$. Although it can hardly be said to have passed beyond the experimental stage, its value appears so great that I deem a full exposition of its principles to be very important.

Unlike the Longmaid, the Ziervogel, and the Augustin processes, this process is applicable both to ores and mattes, but for brevity it will here be spoken of as if applied to ores alone.

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* Transactions American Inst. of Mining Engineers, X, p. 12; Mineral Resources of the United States, Williams, 1883, p. 279; U. S. patent No. 227,902, May 25, 1880. This process is not to be confounded with another patented by the same inventors for treating oxidized copper compounds with $Fe\,Cl_2$ and brine.

### GENERAL OUTLINE OF THE PROCESS.

It may be conveniently divided into the following heads:

*[A] An oxidizing calcination of the ore.

[B] Leaching the calcined ore with the $H_2SO_4$ developed in [D] yielding [2] a solution containing the Cu and [8] residues containing the Ag.

[C] Chloridizing the solution [2] of Cu $SO_4$.

[D] Precipitating the Cu from [2] as $Cu_2$ $Cl_2$ with $SO_2$ gas, producing [3] a solution containing $H_2SO_4$ to be used in [B], and [5] a precipitate of $Cu_2Cl_2$, treated in [F] or [F′].

[F] Treating the $Cu_2Cl_2$ [5] from [D] with milk of lime, producing [6] $Cu_2O$, to be refined, and [7] a solution of chloride of calcium, to be used in [C].

Or [F′] Reduction of [5] with scrap iron, yielding [$6_1$] cement Cu to be refined, and [7′] Fe $Cl_2$, to be used in [C].

[G] Treatment of the residues [8] for Ag by amalgamation, chloridizing and leaching, or smelting.

The Cu is dissolved from the naturally or artificially oxidized copper silver compound [1] by means of $H_2SO_4$ [3] generated cheaply in the process itself, enough Cl being present to chloridize the Ag, which is thus made insoluble and remains in the residue [8] with the Pb, Au, As, and Sb. From the $H_2SO_4$ solution [2] the Cu is precipitated as $Cu_2Cl_2$ (after the addition of enough Fe $Cl_2$ or Ca $Cl_2$ to chloridize it), by hot concentrated $SO_2$ gas from the burning of pyrites or other economical source, an equivalent or more of $H_2SO_4$ being thus generated, which, freed from excess of $SO_2$, is used for dissolving a fresh portion of Cu from the ore under treatment. From the precipitated $Cu_2Cl_2$ the Cu may be readily recovered (according to Hunt) either by reducing it to the metallic state by scrap iron, or to the condition of $Cu_2O$ by milk of lime, thereby generating a corresponding quantity of Fe $Cl_2$ or Ca $Cl_2$, which is used to chloridize the copper-bearing solution from a fresh portion of ore. The cement Cu produced by the Fe or the $Cu_2O$ produced by the CaO is at once refined.

From the residues [8] from which the Cu has been dissolved by our $H_2SO_4$, the precious metals may be recovered [G] by leaching the Ag with brine or hyposulphite of lime or soda (preceded when necessary by a brief chloridizing calcination), and then chlorinating and leaching the Au, [G′] by direct amalgamation, or finally by smelting [G″] if much Pb be present or cheaply available.

### [A] THE CALCINATION.

§ 40. If the Cu occurs as oxide, carbonate, or chloride, it may be at once leached without previous calcination. If, however, it occurs in considerable proportion as sulphide, it must be calcined before leaching. In the latter case the moderately finely ground ore is calcined without salt at a low and gradually rising temperature, the aim being to convert the Ag mainly into sulphate and the Cu mainly into oxide. The Fe will pass mostly into the condition of oxide, and the Pb into that of $PbSO_4$, both but slightly attacked by the solvent employed.

As far as the Cu is concerned, no very great care or thoroughness in the calcination is required, since the solvent is so powerful that it will readily attack incompletely decomposed Cu sulphides, and even portions of the ore which have become somewhat caked. Therefore if the ore is

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* The figures and letters in brackets refer to the accompanying tree.

not to be treated for Ag, the calcination may be rough and rapid, and therefore cheap. For the same reason the ore need not be very finely ground. If Ag is to be extracted from the residues by smelting, the same is true, since the effect of the smelting operation will not be materially altered by any probable variations in the conduct of the calcination. If, however, the Ag is to be extracted by amalgamation or leaching, without calcining it a second time, our calcining must be conducted with more care, converting as much of the Ag as economy will permit into $Ag_2SO_4$, in which state it will be most readily and most thoroughly chloridized in the succeeding operation (extracting the Cu with $H_2SO_4$ in the presence of CuCl), the condition of chloride being so desirable for the subsequent extraction of the Ag from the residues, if by amalgamation, and so necessary if by leaching with brine or hyposulphites. If the Ag is to be extracted by leaching after a subsequent brief chloridizing calcination, as may frequently be desirable, great accuracy in the first or oxidizing calcination is not imperative. If some $Ag_2S$ is undecomposed on the one hand, or if some metallic Ag is formed by overheating $Ag_2SO_4$ on the other, the Ag should still be completely chloridized in the subsequent calcination with salt, though of course with somewhat greater expense and with somewhat greater volatilizing of Ag than if the first calcination had been more accurate.

Since so little delicacy is required in this calcination, it can probably in many cases be performed in revolving or possibly even in Stetefeldt or Gerstenhofer furnaces, thus very greatly diminishing its expense in places where labor is costly.

### [B] LEACHING.

§ 41. The calcined ore is leached or stirred in the vat [B] with the liquor [3], from which a previous portion of Cu has already been precipitated with $SO_2$ [4], and which consists mainly of $H_2SO_4$, with a little HCl, $CuCl_2$, and $Cu_2Cl_2$. Since the ore may contain cuprous compounds, which with HCl would yield $Cu_2Cl_2$, insoluble in the menstrum, hot air is now blown through the liquor, its oxidizing action transforming into soluble $CuCl_2$ any $Cu_2Cl_2$ thus formed (as well as any previously contained in the solution which had escaped precipitation in [D] and [E] in the preceding cycle of operations), and thus preventing its precipitation and loss in the residues. The hot air will at the same time convert any $FeSO_4$ into ferric sulphate $Fe_2(SO_4)_3$, which with $H_2SO_4$ and chlorides of Cu form an exceedingly potent and virile combination, most vigorously attacking any undecomposed compounds of Ag and Cu. This combination is probably far more powerful than any other generally cheaply obtainable solvent yet proposed.* In its power lies the great advantage of this process.

While the presence of a little combined Cl is needed for precipitating the Ag as AgCl and thus retaining it in the residues, no great amount should be present, since both HCl and the various metallic chlorides dissolve AgCl, which they would thus remove with the Cu, from which it could be then separated only with difficulty. It would not be practicable to separate the Ag by mere dilution of the liquor,† since this has to be immediately used again in a concentrated state for treating a fresh portion of ore. The AgCl thus dissolved might perhaps be separated by Claudet's process* with soluble iodide, if we were sure that our injection of hot air had completely converted into $CuCl_2$ the $Cu_2Cl_2$ which so seriously interferes with the separation of Ag I. This action of hot air on $Cu_2Cl_2$ is so rapid and complete in the laboratory that it is probable that it can be made throroughly effective on the large scale, although several metallurgists have unsuccessfully attempted to perchloridize in this way the $Cu_2\ Cl_2$ formed in the Longmaid process. (See § 23.)

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*The solvents proposed for the processes of Deby and Doetsch (Nos. 32 and 33 in Table I) are indeed of great power. But I do not know that the practicability of forming Deby's solvent is yet demonstrated, and the solvent employed in the Doetsche process would appear to be generally costly, since its regeneration depends on the use of chlorine gas.

† Process 22, Table I.

We have now two products, a solution [2] containing all the Cu, and residues [8] containing the Ag, whose further treatment is described beyond in §§ 42 and 43.

### [C] CHLORIDIZING THE SOLUTION.

§ 42. The copper-bearing solution is now removed to another vat, where it is mixed with a little more of some soluble chloride ($CaCl_2$, [7] or $FeCl_2$, [7]) regenerated in the process itself in [F] than suffices to combine with the dissolved Cu to form $Cu_2Cl_2$, in which state it is to be separated in the succeeding operation [D] with $SO_2$ gas. A considerable excess of Cl is to be avoided, since it would not be precipitated as $Cu_2Cl_2$ by the $SO_2$, but would be returned in the $H_2\ SO_4$ solution [3] to a fresh batch of ore, from which, as explained in [B], it would (as HCl or metallic chlorides) dissolve AgCl.

In case $CaCl_2$ is used, on mixing it with the copper-bearing solution [2] nearly all the Ca will precipitate as $CaSO_4$, which should be separated by decantation or filtering before the precipitation of the Cu by $SO_2$, so that it may not contaminate the precipitated $Cu_2Cl_2$.

### [D] PRECIPITATING THE COPPER.

§ 43. A Knowles pump, an injector, or other suitable apparatus now forces through the chloridized liquor a stream of hot strong $SO_2$ obtained from burning the ore itself or other suitable sulphur-bearing substance.† If the $SO_2$ be strong and nearly free from air and if the solution be hot the Cu is rapidly and nearly completely precipitated, in accordance with the following reaction

$$CuCl_2 + CuSo_4 + So_2 + 2\ H_2O = Cu_2Cl_2 + 2\ H_2So_4.$$

Mr. Douglas states‡ that one part by weight of S as $So_2$ will precipitate about two parts of Cu, which is about half what it should theoretically do, the discrepancy being due to the inevitable presence of free O in the $SO_2$, and to the incomplete oxidation of the $SO_2$. The incompleteness of the precipitation of the Cu by the $SO_2$ does no harm, as the solution is used over and over again, and the Cu not precipitated is not lost. The solution, thus deprived of its Cu by the $SO_2$ but rich in free $H_2SO_4$, can now be used for leaching a fresh portion of ore, taking care to first remove any $SO_2$ which remains in it, since this would cause the precipitation and loss of $Cu_2Cl_2$ in the residues. This may be effected by blowing hot air through it, preferably while leaching, as already described in [B], § 41, or by mixing it before leaching with a portion of the Cu bearing liquor [2] which has not been treated with $SO_2$, the $CuCl_2$ of which will react on the residual $SO_2$ according to the equation just given, with precipitation of $Cu_2Cl_2$. In either case the solution should be allowed to cool before using it to leach a fresh portion of ore, when a considerable amount of $Cu_2Cl_2$ will settle out. And so the operation goes on indefinitely, the solution alternately dissolving Cu from the ore and being deprived of it by the $SO_2$. Eventually Fe and Zn (and Ni and Co if present) will accumulate in the solution, from which they may be recovered by crystallizing.

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* See § 23 and Process 19, Table I.

† Blende was formerly successfully used at the Bergen Point (N. J.) Chemical Works for making sulphuric acid, and also at several places in Europe. At Oker (Lunge's Sulphuric Acid and Alkali, I, pp. 247 and 115), iron pyrites even when containing as much as 35 per cent. of chalcopyrite (0.35 × 34.6 = 12. 11 Cu ?) is successfully used for acid making, as is also a mixture of 35 per cent. blende with 25 per cent. pyrites. The sulphur of galena is hardly available for acid making, since $SO_2$ can only be obtained from it at a very high temperature. Coarse metal, a comparatively lean copper matte, with say 34 per cent. Cu, 34 per cent. Fe. and 28 per cent. S, yields a gas with 5.5 per cent. $SO_2$, which is used for acid making at Mansfeld, and lead matte yields a gas with from 4 to 6 per cent. $SO_2$, which is used for the same purpose at Freiberg. The richest possible gas economically allowable for acid-making can only have, according to Lunge (*Loc. Cit.*, p. 246), 8.59 per cent. of $SO_2$. But while these several substances yield gas rich enough in $SO_2$ for acid-making, which indeed actually requires a considerable excess of free O above that needed to combine with the $SO_2$ to form $H_2SO_4$ ($SO_2 + O + H_2O = H_2SO_4$) it by no means follows that their gas will be rich enough for the Hunt and Douglas process, whose essence is that the $SO_2$ shall be oxidized, not by free O accompanying it in the gas, but at the expense of the $CuSO_4$, according to the equation given in this section. Actual experiment, therefore, can alone decide what substances will yield $SO_2$ strong enough for this process; but it must be freely conceded that it may and probably will require gas with a higher ratio of $SO_2$ to O than suffices for acid-making; and that substances fitted for the latter operation may not yield a gas rich enough in $SO_2$ for the former.

‡ Mineral Resources of the United States. Williams, 1883, p. 279.

*Increasing the strength of the solution.*—If our $SO_2$ is accompanied by an excess of air, the $Cu_2Cl_2$ which it precipitates will rapidly absorb O from that air, passing first into oxychloride, and then into $CuCl_2$ and $CuSO_4$. These salts in turn react on the $SO_2$, yielding $H_2SO_4$ according to the last equation, being simultaneously reprecipitated as $Cu_2Cl_2$, again absorbing O, and so on. By this means we can increase indefinitely the amount of $H_2SO_4$ present, the copper salts *carrying* O from the air to the $SO_2$, as the nitrous oxide does in the ordinary manufacture of $H_2SO_4$. The same principle is made use of in originally preparing the leaching solution [3]: a portion of ore is so calcined that most of its Cu exists as $CuSO_4$, which is dissolved out with water, chloridized and strengthened in $H_2SO_4$ as just described.

*As and Sb.*—If brimstone, pyrite, or other extraneous source of $SO_2$ be employed, it is desirable that it should be nearly free from As and Sb, since these noxious metals would sublime and distill over with the $SO_2$ as sulphides, and as As, $As_2O_3$ and $Sb_2O_3$, mingle with the precipitated $Cu_2Cl_2$ and contaminate the resulting Cu. If the substance treated for Cu and Ag is the source of its own $SO_2$, As and Sb contained in it will to a certain extent pass over with the $SO_2$ and consequently contaminate the resulting Cu, but probably to a much less extent than in most other processes, since much of these noxious elements will remain in the insoluble residue along with the Ag, while their compounds actually dissolved are said not to be precipitated by the $SO_2$. As, Sb, and their volatile compounds may be largely prevented from passing over to the cuprous solution by allowing the $SO_2$ gas to pass slowly through a large cooling flue. They might even be condensed in water, though here special precautions would have to be taken to prevent heavy loss of $SO_2$, which is greedily dissolved in water. This, however, need present no insuperable difficulty, since by proper arrangements the condensing water can be used over and over without allowing the $SO_2$ it has dissolved to escape.

### [F] REDUCING THE PRECIPITATED $Cu_2Cl_2$.

§ 44. This may be done either with scrap iron or milk of lime.

*Scrap iron* inserted in the moist $CuCl_2$ rapidly reduces it to the metallic state. The cement Cu [6′] thus obtained is much purer than that obtained in other processes, and the consumption of scrap iron very much less, for the following reasons.

In other processes the Cu is precipitated from solutions which generally contain ferric salts, which consume iron thus:

$$Fe_2\,(SO_4)^3 + Fe = 3FeSO_4.$$

Now, if the air be admitted, the ferrous salt thus formed is in turn converted into basic ferric salt, which in part precipitates with the cement Cu, from which it has to be separated at great cost, and in part attacks fresh portions of iron, thus:

$$30FeSO_4 + 15,O = Fe_2\,(SO_4)^3\,5Fe_2O_3 + 9Fe_2(SO_4)^3.$$

Next $6Fe_2\,(SO_4)^3 + 15Fe + 15,\,H_2O = 15FeSO_4 + Fe_2\,(SO_4)^3, 5Fe_2O_3 + 30,H$. The $Fe_2\,(SO_4)_3$, $5Fe_2O_3$ precipitates with the Cu. In chloride solutions reactions occur parallel with these.

In the Hunt & Douglass process, however, our $Cu_2Cl_2$ is accompanied by no iron salts; and, if the air be excluded, the $FeCl_2$ formed by the reduction of the $Cu_2Cl_2$ cannot pass into the ferric state, and hence can neither consume iron nor contaminate the cement Cu. The consumption of Fe should therefore be but slightly above the theoretical requirement, 0.442 parts of Fe to 1 part of Cu, while in other processes in which Cu is precipitated by scrap iron the consumption of Fe rarely falls below 1 to 1 part of Cu, and it is frequently as high as 3 to 1.

*Milk of lime*, preferably boiling, rapidly converts $Cu_2Cl_2$ into $Cu_2O$ [6] yielding $CaCl_2$. This inexpensive reagent cannot in general be advantageously used in other processes, because it precipitates with the Cu the Fe which accompanies it in the solution, their subsequent separation being costly. In this process, however, it seems eminently desirable since no Fe is present. The only inconvenience its use entails is the removal of the $CaSO_4$ which precipitates when the $CaCl_2$ formed by the reduction of the $Cu_2Cl_2$ is used to chloridize the $CuSO_4$ solution in [C], and this should be an easy matter.

The *cement copper* [6′] from reduction by iron and the *cuprous oxide* [6] from treatment by lime can be at once passed to the refining furnace, being free from the impurities (basic ferric salts, arsenic, antimony, &c.), which render it necessary to subject ordinary cement copper to at least one preliminary oxidizing fusion before refining it.

The $Cu_2O$ produced by treatment with milk of lime would be easily reduced to the metallic state and immediately refined. By bricking it with charcoal dust the reduction could probably be readily effected while melting down in the refining furnace. The refining operation would be very easy and short, because the metal would be wholly free from Fe. Any S distilled over with the $SO_2$ would accompany the precipitated $Cu_2Cl_2$ and be found in the $Cu_2O$. It would be wholly expelled as $SO_2$ on heating the $Cu_2O$ in the refining furnace.

While Messrs. Hunt & Douglass state that the reduction of the precipitated $Cu_2Cl_2$ is readily effected either by milk of lime or by iron, other metallurgists report that they have experienced considerable difficulty in effecting it.

### [G] EXTRACTING THE Ag FROM THE RESIDUES.

§ 45. The residues are now practically rich silver ores, with but little Cu and Pb, like those of class A in Table I, § 2, where the methods suitable for their treatment under various conditions are suggested.

Dr. Hunt* states that brine has readily dissolved the Ag from these residues. If the original calcining is carefully conducted so as to convert the greater part of the Ag into $Ag_2SO_4$, the action of the powerful solvent employed for leaching the Cu, containing much free $H_2SO_4$, together with chlorides of Fe and Cu, would doubtless chloridize and thus render solubled in brine much if not most of the Ag, even in the case of many very rebellious ores. The use of this process, however, has not been sufficiently extended to enable us to predict that there are no ores which will not require an additional chloridizing calcination to thoroughly chloridize their Ag. Hyposulphite of lime or soda may, in many cases, prove a cheaper and more efficient solvent than brine. Should the residues be very rich in Ag they might be directly cupelled or smelted with lead, and, even if they are not very rich, smelting might be desirable, if fuel were cheap, the residues readily fluxed, and either lead, or lead- or matte-yielding substances readily available; again, amalgamation might be desirable, especially if the residues were lean or hard to flux, and fuel and salt expensive.

## ADVANTAGES OF THE PROCESS.

§ 46. 1 The solvent is self-regenerating, cheaply obtained, and of remarkable power, containing $H_2SO_4$ and ferric and cupric salts, among the most powerful agents for decomposing sulphides of Cu and Ag and for chloridizing metallic silver.

(2) The calcination is comparatively simple and cheap, and very fine grinding is not necessary, thanks to the power and virility of the solvent.

(3) Reagents cost next to nothing, almost no salt being required.

(4) Precipitant.—It is claimed that the Cu may be advantageously recovered by milk of lime, a reagent generally inapplicable in other processes. Even if iron be used as a precipitant hardly more than half as much would be needed as in other processes (*e. g.*, the Longmaid, Doetsch, &c.), in which the copper is precipitated by that metal.

(5) Silver and gold.—The precious metals are (it is claimed) in an excellent condition for leaching with brine or hyposulphite of lime, or for amalgamation, though more experience is needed to show whether a short additional chloridizing calcination may not be needed in case the Ag is to be extracted as chloride from the residues of rebellious ores.

(6) Purity of the copper.—The resulting copper is free from As and Sb, even when these elements are present in the ore in large quantity, and it is also very free from iron.

(7) Calcareous ores.—Since in this process the amount of free $H_2SO_4$ present can be in increased indefinitely and simply at the cost of a corresponding amount of $SO_2$, it can be directly applied to ores containing even large amounts of CaO, MgO, &c. Since these strong bases consume the acid of the solvent, ores containing them in considerable quantity cannot be directly treated by other wet methods.

(8) Cobalt and nickel, if present even in minute quantities, will accumulate in the solution [3] from which they may be recovered when they have reached profitable proportions.

(9) The plant required is probably less costly per unit of capacity than those needed for the Augustin, Ziervogel, and sulphuric acid processes (at least for ores yielding a large proportion of matte), if we include the furnaces needed for the preliminary calcinings and smeltings for these

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* Transactions Amer. Inst. Mining Engineers, 1882, X, p. 19.

processes. However, since the furnaces needed for these preliminary operations generally form part of a general smelting and refining plant, the additional plant required to adapt such an establishment to the Hunt & Douglas process would probably be more costly than that required for the adoption of these other processes, especially for ores yielding but a small amount of matte. The plant will probably be less costly than that of the Longmaid process.

(10) The loss of copper will probably be small.

Disadvantages.—It is hard to foretell what the disadvantages of a comparatively untried process will be, since many obstacles which appear at first may be completely overcome, while unforeseen but serious ones may arise. The following drawbacks, however, are at least worthy of consideration :

(1) Its complexity.

(2) The considerable uncertainty as to whether the transformation of the residual $Cu_2Cl_2$ into $CuCl_2$ by a blast of air can be quickly and surely effected.

(3) The uncertainty as to whether the actual treatment of the precipitated $Cu_2Cl_2$ on a large scale may not present grave inconveniences.

(4) It may be found difficult in practice to add just enough chloride to the solution [2] to completely chloridize its Cu, without adding such an excess as to dissolve some Ag when the decopperized solution is returned to leach fresh portions of ore.

## APPLICABILITY OF THE PROCESS.

§ 47. Since the essence of the process is the simultaneous precipitation of Cu and the regeneration of the solvent $H_2SO_4$ by the action of a great excess of strong $SO_2$ on $CuCl_2$, it can only be applied where either the substance operated on or some other and cheaply obtainable material is capable of yielding this gas. $SO_2$ can certainly be obtained of sufficient strength from brimstone and even moderately impure pyrites, and perhaps in skillful hands from blende, copper pyrites, and even lead and copper mattes rich in sulphur. Where strong $SO_2$ can be cheaply obtained this process promises to have a very broad range of applicability, and it may even prove desirable for many ores which are generally considered especially suited for smelting. It should, however, be especially desirable for lean and difficultly fluxed ores, and for even comparatively rich ores and mattes which carry either arsenic or antimony or (in case of ores) lime or magnesia, where power, fuel, salt, sulphuric acid, iron and refractory materials are costly, and where the superintendence is skillful and intelligent.

Where fuel is very cheap, only pure materials to be treated, and highly skilled labor attainable it may yield the palm to the *Ziervogel;* to the *Augustin* where the materials are comparatively pure and free from zinc and fuel is cheap; to the *Patera* where salt is cheap and the ore comparatively lean in copper and rich in silver; to the *Longmaid* (Henderson) especially as an adjunct to sulphuric acid works where salt and iron are very cheap and the ore is simply pyrite with no gangue and with less than 4 per cent. of copper; to the *Sulphuric acid* process where there is a local demand for bluestone and an abundant cheap supply of sulphuric acid, and to *Electrolysis* where rich ores and cheap fuel favor smelting, and water-power is available.

Even where sulphuric acid is cheap, provided that bluestone is not in demand, the Hunt & Douglas process may prove more desirable than the sulphuric acid process, even for the treatment of matte and black copper, since, with proper appliances, for a given amount of copper the former process should not require as much sulphur in the shape of sulphurous anhydride ($SO_2$) as the latter needs in the shape of sulphuric acid; theoretically it should require only half as much. But, since in these places sulphur is usually practically dear on account of its value for acid making, the Hunt & Douglas process should prove more especially attractive in remote places where there is a supply of sulphur, but no great local demand either for sulphuric acid or for bluestone, the sulphurous anhydride fumes evolved in burning pyritic ores in these places being usually not merely a by-product but a serious nuisance, and their absorption as effected by this process a blessing to the community.

*Table showing the effects of certain substances on silver and some of its compounds.*

[LEGEND.—The action of the several reagents on silver and its salts is indicated by the Greek letters, as follows:

$\alpha$ Dissolves it slightly.
$\alpha\,\alpha$ Dissolves it.
$\alpha\,\alpha\,\alpha$ Dissolves it copiously.
$\beta$ Does not dissolve it.
$\gamma$ Precipitates it.
$\delta$ Forms or causes the formation of.
$\epsilon$ Completely.
$\zeta$ Partially.
$\eta$ The reaction is hindered by.
$\eta\,\eta$ The reaction is prevented by.
$\theta$ The reaction occurs in the presence of.
$\theta\,\theta$ The reaction occurs only in presence of.
$\iota$ When heated in the wet way.
$\iota\,\iota$ Only when hot.
$\kappa$ When cold.
$\kappa\,\kappa$ Only when cold.
$\iota-\kappa$ Hot or cold.
$\iota\,\iota-\kappa$ More when hot than cold.
$\kappa\,\kappa-\iota$ More when cold than hot.
$\lambda$ When molten, *i. e.*, in igneous fusion.
$\mu$ When solid.
$\xi$ When gaseous.
$\nu$ When liquid or in solution.
$\pi$ Solubility decreases on dilution.
$\rho$ More or especially when concentrated.
$\rho\,\rho$ Only when concentrated.
$\tau$ Is inert.
$\phi$ Decomposes it.
$\psi$ The reaction is favored by the presence of.
$\omega$ When heated in the dry way without fusion, *e. g.*, in calcining.]

| Name. | Hg, Mercury. | Zn, Fe, Pb, Ni, Co, Cu. | As, Sb, Cd, Bi, Sn. | FeSO$_4$. | Ferric sulphates. | FeCl$_2$ and Fe$_2$Cl$_6$. |
|---|---|---|---|---|---|---|
| Silver. | $\delta$ AgHg$_x$ $\iota-\kappa$. | | As $\lambda\,\delta$ Ag$_3$As.<br>$\omega$ As and Sb, $\delta$ Ag$_3$AsO$_4$, and Ag$_3$SbO$_3$ $\theta$ air. | | Fe$_2$(SO$_4$)$_3$<br>$\alpha\,\alpha$ as<br>Ag$^2$SO$_4$.<br>$\psi$ H$_2$SO$_4$. | Fe$_2$Cl$_6$<br>$\nu\,\delta$<br>AgCl. |
| Chloride of silver, AgCl. | $\delta$ AgHg$_x$.<br>$\psi$ Fe, FeSO$_4$, NaCl, CuSO$_4$ and alum. | Cu $\delta$ Ag $\epsilon\,\nu$, $\theta$ NaCl.<br>Cu, Zn, Fe, and Pb.<br>$\kappa\,\mu\,\delta$ Ag. | | $\tau$. | | |
| Iodide of silver, AgI. | $\delta$ AgHg$_x$. | Zn $\delta$ Ag $\theta$ HCl. | | | | |
| Bromide of silver, AgBr. | $\delta$ AgHg$_x$. | Zn $\delta$ Ag $\epsilon$, $\theta$ HCl. | | | | |
| Sulphide of silver, Ag$_2$S. | $\delta$ Ag, $\mu$, $\iota-\kappa$;<br>$\psi$ NaCl. | Fe $\delta$ Ag $\epsilon\,\lambda\,\eta\,\eta$ Cu$_2$S.<br>Fe and Zn $\delta$ Ag $\mu$, $\theta\,\theta$ HCl.<br>Cu and Pb $\delta\,\lambda$ Ag $\zeta$.<br>Cu $\delta$ Ag $\mu$, $\theta$ H$_2$O. | | $\delta$ AgCl,<br>$\theta$ NaCl,<br>$\theta\,\theta$ Air. | Basic Sulphate<br>$\delta$ AgCl,<br>$\theta$ NaCl. | |
| Oxide of silver, Ag$_2$O. | $\delta$ Ag, $\nu$ in H$_2$O or NH$_4$HO. | Zn, Pb, and Cu, $\delta$ Ag, $\nu$ in H$_2$O.<br>Fe, Ni, and Co $\tau\,\nu$ in H$_2$O.<br>Zn, Cu, and Pb $\delta$ Ag, $\nu$ in NH$_4$HO.<br>Fe and Ni $\tau$, $\nu$ in NH$_4$HO. | Cd and Sn $\delta$ Ag $\nu$ in H$_2$O.<br>Cd & As $\delta$ Ag $\nu$ in NH$_4$HO.<br>Bi and Sn $\tau\,\nu$ in NH$_4$HO. | | | |
| Sulphate of silver, Ag$_2$SO$_4$. | | Cu, Fe, Zn, and Pb $\gamma$ Ag $\epsilon$. | Sn $\gamma$ Ag $\epsilon$. | $\delta$ Ag. | | |
| Nitrate of silver, AgNO$_3$. | $\delta$ AgHg$_x$,<br>$\nu$ in H$_2$O. | $\lambda$ Fe $\tau$. Fe $\delta$ Ag $\nu$ in H$_2$O, $\theta\,\theta$ air or acid.<br>$\lambda$ Zn and Cu $\delta$ Ag.<br>Pb, Zn, Cu $\delta$ Ag, $\nu$ in H$_2$O. | Cd and Sn $\lambda\,\delta$ Ag.<br>Sn, Cd, Bi, As, and Sb $\delta$ Ag $\nu$ in H$_2$O. | $\gamma$ Ag $\epsilon$. | | FeCl$_2$<br>$\gamma$ as<br>AgCl. |
| Proustite, 3Ag$_2$S, As$_2$S$_3$. | $\delta$ AgHg$_x$. Slowly. | | | | | |
| Pyrargyrite, 3Ag$_2$S, Sb$_2$S$_3$. | $\delta$ AgHg$_x$. Slowly. | | | | | |

*Table showing the effects of certain substances on silver and some of its compounds*—Continued.

| Name. | $CuSO_4$. | $CuCl_2$. | $Cu_2Cl_2$. | $HgCl_2$. | $Hg_2Cl_2$. | Alkalies. | Alkaline salts. |
|---|---|---|---|---|---|---|---|
| Silver. | $\lambda\,\delta$ $AgO_x$. | $\nu$ in $H_2O$ $\delta$ AgCl $\psi$ NaCl.<br>$\nu$ in $NH_4HO$ $\tau$. | | $\nu$ in $H_2O$ $\delta$ AgCl. | | KHO and NaHO $\lambda\,\tau$. | $KNO_3$ and $NaNO_3$ $\lambda\,\tau$.<br>KI $\lambda\,\delta$ AgI.<br>KI $\nu$ in $H_2O$ $\delta$ AgI. |
| Chloride of silver, AgCl. | | $\nu$ in $NH_4HO$,<br>$\delta$ Ag & $CuCl_2$.<br>$\nu$ in NaCl $\tau$. | | | | KHO $\nu\,\iota\,\delta$<br>$Ag_2O$ $\rho\,\rho$.<br>$NH_4HO$ $\alpha\,\alpha\,\alpha$. | $Na_2CO_3$ and $K_2CO_3$ $\lambda\,\delta$ Ag.<br>KCl $\alpha\,\alpha\,\rho\,\pi$.<br>KCy $\alpha\,\alpha$. |
| Iodide of silver, AgI. | | | | | | KHO $\iota\,\iota$–$\kappa$<br>$\rho\,\rho\,\alpha\,\alpha$. | $NaCO_3$ $\lambda\,\delta$ Ag.<br>KCy $\alpha\,\alpha$, KI $\alpha$, $\iota\,\iota$–$\kappa$. |
| Bromide of silver, AgBr. | | | | | | $NH_4HO$ $\alpha\,\alpha\,\rho\,\pi$. | KCy $\alpha\,\alpha$. KCl $\alpha\,\alpha\,\rho\,\rho$.<br>$Na_2CO_3$ $\lambda\,\delta$ Ag. KBr and NaBr $\alpha\,\rho\,\rho$.<br>$NH_4Cl$ $\alpha\,\alpha\,\iota$. |
| Sulphide of silver, $Ag_2S$. | $\delta$ AgCl<br>$\theta$ NaCl<br>Air and Water. | $\nu\,\delta$ AgCl,<br>$\iota\,\iota$–$\kappa$. | $\delta$ AgCl, $\theta\,\theta$<br>Air: $\psi$<br>NaCl. | | | KHO, NaHO, and $NH_4HO$ $\nu\,\beta$.<br>KHO $\lambda$–$\delta$ Ag $\zeta$. | $(NH_4)_2CO_3$, KCl, $NH_4Cl$, $Na_2CO_3$ and $K_2CO_3$ $\nu\,\beta$.<br>$Na_2CO_3$, KCl, and KCy $\lambda\,\delta$ Ag $\zeta$.<br>$KNO_3$ $\mu\,\delta$ Ag $\epsilon$. $Na_2SO_4$ $\lambda\,\tau$. |
| Oxide of silver, $Ag_2O$. | | | $\nu\,\delta$ AgCl (?). | $\nu\,\delta$<br>AgCl (?). | $\theta$ $H_2O$<br>$\delta$ AgCl (?). | $NH_4HO$ $\alpha\,\alpha$.<br>NaHO and KHO $\beta$. | $(NH_4)_2CO_3$, KCy, and NaCy $\nu\,\alpha\,\alpha$. |
| Nitrate of silver, $AgNO_3$. | | | | | $\iota\,\delta$<br>AgCl. | | |
| Arseniate of silver, $Ag_3AsO_4$. | | | | | | $NH_4HO$ $\alpha\,\alpha$. | $(NH_4)_2CO_3$, $\alpha\,\alpha$. |
| Antimoniate of silver, $3Ag_3SbO_3$. | | | | | | KHO boiling $\delta$ $Ag_2O$. | |
| Hyposulphite of silver, $Ag_2S_2O_3$. | | | | | | | $K_2S_2O_3$ $\alpha\,\alpha\,\alpha$. |
| Proustite, $3Ag_2S$, $As_2S_3$. | | $\delta$ AgCl. | $\phi$. | | | | |
| Pyrargyrite, $3Ag_2S$, $Sb_2S_3$. | | $\delta$ AgCl $\zeta$. | $\nu$ in NaCl,<br>$\phi\,\iota$. | | | | |

*Table showing the effects of certain substances on silver and some of its compounds*—Continued.

| Name. | NaCl. | $Na_2S_2O_3$, hyposulphite of soda. | CaO and BaO. | Salts of Ba, Sr, Ca, and Mg. | Oxides of Pb, Mn, and Ag. | Cuprous oxide, $Cu_2O$. | Cupric oxide, CuO. |
|---|---|---|---|---|---|---|---|
| Silver. | λ δ AgCl,<br>π π Cu.<br>ν δ AgCl, slowly,<br>θ θ air. | α. | | | $Pb_3O_4$ and $MnO_2$,<br>ω δ $AgO_x$,<br>$Pb_2O$ and MnO. | | ω δ $Ag_xO$. |
| Chloride of silver, AgCl. | α α ν, ρ<br>ι ι–κ, π. | α α α, ι–κ,<br>η η KI, and KBr. | CaO τ. | $CaCl_2$ and $MgCl_2$ ν α α, ι–κ.<br>$CaCO_3$ ω δ Ag.<br>$CaCO_3$ ι τ. | | δ Ag θ θ<br>$FeSO_4$<br>$CuSO_4$<br>Or alum. | |
| Iodide of silver, AgI. | α α ρ ρ. | κ α, but KBr γ. | | | | | |
| Bromide of silver, AgBr. | | κ α α. | | | | | |
| Sulphide of silver, $Ag_2S$. | ω δ AgCl,<br>θ steam. | β. | CaO<br>τ λ. | | $Ag_2O$, $Ag_2SO_4$, and PbO λ δ<br>Ag and $AgPb_x$. | | λ δ $Cu_2Ag$. |
| Oxide of silver, $Ag_2O$. | ι δ AgCl. | κ α α α, but KBr γ. | BaHO β. | $BaCy_2$, $SrCy_2$, $CaCy_2$, and $MgCy_2$ α α. | | | |
| Sulphate of silver, $Ag_2SO_4$. | δ AgCl,<br>ω and ν. | δ $Ag_2S$. | | | | γ Ag. | |
| Nitrate of silver, $AgNO_3$. | | | | | | γ Ag. | |
| Arseniate of silver, $Ag_3AsO_4$. | β. | α α. | | | | | |
| Hyposulphite of silver, $Ag_2S_2O_3$. | | α α α. | | $CaS_2O_3$ α α α. | | | |

*Table showing the effects of certain substances on silver and some of its compounds*—Continued.

| Name. | Metallic sulphides. | Chlorine, Cl. | Sulphurous anhydride, $SO_2$. | Sulphureted hydrogen, $H_2S$. | Hydrochloric acid, HCl. | Sulphuric acid, $H_2SO_4$. | Nitric acid, $HNO_3$. | Carbonic oxide, CO. | Water, $H_2O$. | H. |
|---|---|---|---|---|---|---|---|---|---|---|
| Silver. | $Ag_2S$<br>λ α α α. | δ AgCl ι–κ,<br>ξ or ν. | | ι–κ δ<br>$Ag_2S$. | δ AgCl<br>ω. | δ and α α α<br>$Ag_2SO_4$ ρ ρ,<br>ι ι–κ. | α α,<br>ι ι–κ,<br>ρ. | | | |
| Chloride of silver, AgCl. | | | β, ι–κ. | γ $Ag_2S$,<br>ν in $NH_4HO$. | α, ι ι–κ,<br>π. | δ $Ag_2SO_4$<br>ρ ρ and ι ι. | β, ιι–κ. | ω δ<br>Ag. | β. | ω δ Ag and<br>HCl. |
| Iodide of silver, AgI. | | ω δ AgCl. | | | | φ, ρ ρ. | φ, ρ ρ. | | β. | |
| Bromide of silver, AgBr. | | ω δ AgCl. | | | α ρ ρ. | α ρ, π.<br>φ when boiling. | τ, ι–κ. | | β. | |
| Sulphide of silver, $Ag_2S$. | | ξ or ν δ AgCl,<br>ι ι–κ. | β. | | δ AgCl<br>ι ρ ρ. | φ and α α, ρ ρ. | φ, ρ ρ,<br>ι ι–κ. | | β. | |
| Oxide of silver, $Ag_2O$. | | | ν δ Ag and<br>$Ag_2SO_4$. | | | | α α α. | | α. | |
| Sulphate of silver, $Ag_2SO_4$. | | | | | | α α α, ρ,<br>ι ι–κ, π. | α α. | | α α α,<br>ι ι–κ. | |
| Nitrate of silver, $AgNO_3$. | $Cu_2S$ δ $Ag_2S$<br>and Ag ν. | ω and<br>ν δ AgCl. | | | | | γ, ρ ρ. | | α α α,<br>ι ι–κ. | |
| Arseniate of silver, $Ag_3AsO_4$. | | | | | δ AgCl. | | | | β. | |
| Antimoniate of silver, $3Ag_3SbO_3$. | | | | | ω δ<br>AgCl. | δ $Ag_2SO_4$<br>ι, ρ ρ. | φ ζ. | | β. | |
| Hyposulphite of silver, $Ag_2S_2O_3$. | $Na_2S$ δ<br>$Ag_2S$ ε<br>ν in $Na_2S_2O_3$. | | | | | | | | α. | |

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